l. PURPOSE. This Advisory Circular (AC) provides acceptable certification methods, but not necessarily the only acceptable methods, for demonstrating compliance with the crashworthiness requirements of Part 25, as amended through Amendment 25-70, of the Federal Aviation Regulations (FAR) for transport category airplanes. The guidance in this AC is not mandatory nor a regulation.

2. CANCELLATION. AC 25-17, Transport Airplane Cabin Interiors Crashworthiness Handbook, dated July 15, 1991, is canceled.

3. BACKGROUND.

a. Crashworthiness, as applied to airplane cabin interiors, denotes the incorporation in basic design of considerations pertinent to the protection of airplane occupants in a "survivable crash environment." A survivable crash environment prevails when the cabin occupants are subjected to crash forces within human tolerance levels, and the structural integrity of the passenger space remains intact such that the occupants can rapidly evacuate the airplane. Structural design for airplane safety has embodied airworthiness and crashworthiness design objectives to varying degrees. Airworthiness design objectives pertain to the ability of the airframe to withstand design loads, or to maintain safety of flight of the airplane relative to the operational environment. Crashworthiness design objectives pertain to safety of the occupants relative to the airplane. Some aspects of crashworthiness, e.g., fuel tank/system design, fuselage deformation and prevention of post-crash fires, are beyond the scope of this AC.

b. Since the inception of federal civil aircraft certification standards, prime emphasis has focused on design for airworthiness, with a preference for application of static load tests, as opposed to dynamic. The emphasis on airworthiness is understandable, since structural and handling deficiencies were inherent in early airplane designs. Further, there was not enough theoretical or technical knowledge available from service experience to generate meaningful design parameters for crash survival. Likewise, in early design, as now, dynamic criteria have been difficult to ascertain. Except for standards for seat belts, seat static load requirements, and exits, crashworthiness was given very little attention until the post-World War II period. During subsequent years, emphasis on crashworthiness was expanded by the regulatory process. A significant change occurred in 1967, when the Federal Aviation Administration (FAA) promulgated a series of crashworthiness standards affecting transport category airplanes. Further

changes were implemented in 1972. As reflected in the rule changes of 1967, the FAA's approach to crashworthiness principally involved three areas of concern: (1) protection of airplane occupants from crash impact; (2) minimizing development and severity of potential crash fire; and (3) rapid evacuation of airplane occupants. Each of these factors has been a focal point in the periodic upgrading of regulatory standards.

c. Part 4b of the former Civil Air Regulations (CAR) was recodified in 1965 as Part 25 of the FAR. The related policy material contained in Civil Aeronautics Manual (CAM) 4b was applicable to Part 25 as originally recodified and to current Part 25 except in areas that have been amended since recodification. Those policies are included in this AC and listed as guidance applicable to the original recodified version of Part 25.

d. This AC consists of the original Part 25 of the FAR (1965 recodified version), followed by appropriate guidance. Amendments to the regulation are presented in chronological order, with only those paragraphs changed by the amendment reprinted. If additional guidance exists for an amended rule, it is presented following the amended paragraphs. Unless otherwise noted, guidance for the basic rule applies to amended versions of the rule as well. Additionally, guidance for an amendment will apply to later amendments, unless otherwise noted.

e. Certain changes, such as an increase in passenger seating capacity, or the airplane operating rules, may require compliance with rules later than the type certification basis. Refer to §§ 21.101(a), 25.2, 91.58, 121.310, 121.311, 121.312, 121.317, 121.318, 121.319, 125.113, 135.170, and Appendix A of part 135 of the FAR.

f. Advisory circulars listed in Appendix 3 may be revised after issuance of this AC. The latest available revision of the listed AC should be used.

4. APPLICABILITY. Available guidance pertaining to Part 25 is presented according to the amendment level of Part 25 to which it applies. For modified airplanes certificated under Part 25, the pertinent guidance may be obtained from this AC by reference to the applicable amendment level. (Compliance with later rules may be required in accordance with §§ 21.101(a) and 25.2, or with applicable operating rules as noted above.) Additional guidance may be included in this AC that pertains to either prior amendments or sections that have not been modified. This guidance has been developed to address issues that either have developed since the original issue of this AC, or were inadvertently omitted. The guidance presented in this AC for Part 25 airplanes may be used for airplanes certificated under CAR 4b to the extent the rules contained in the older certification bases are the same as those of Part 25. The guidance presented herein applies to Part 25 through Amendment 25-70.

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TABLE OF CONTENTS

101. Regulation in Effect at Adoption of Part 25.
102. Amendment 25-32, Effective May 1, 1972.
103. Amendment 25-38, Effective February 1, 1977.
104. Amendment 25-51, Effective March 6, 1980.
105 - 120. [RESERVED]

Go to SECTION 25.789 RETENTION OF ITEMS OF MASS

121. Section 25.789 Did Not Exist Prior to Amendment 25-32.
122. Amendment 25-32, Effective May 1, 1972.
123. Amendment 25-46, Effective December 1, 1978.
124 - 140. [RESERVED]

Go to SECTION 25.791 PASSENGER INFORMATION SIGNS

141. Section 25.791 Did Not Exist Prior to Amendment 25-32.
142. Amendment 25-32, Effective May 1, 1972.
143 - 160. [RESERVED]

Go to SECTION 25.793 FLOOR SURFACES

161. Section 25.793 Did Not Exist Prior to Amendment 25-51.
162. Amendment 25-51, Effective March 6, 1980.
163 - 250. [RESERVED]

Go to SECTION 25.801 DITCHING

251. Regulation in Effect at Adoption of Part 25.
252 - 270. [RESERVED]

Go to SECTION 25.803 EMERGENCY EVACUATION

271. Regulation in Effect at Adoption of Part 25.
272. Amendment 25-1, Effective June 7, 1965.
273. Amendment 25-15, Effective October 24, 1967.
274. Amendment 25-17, Effective June 20, 1968.
275. Amendment 25-20, Effective April 23, 1969.
276. Amendment 25-32, Effective May 1, 1972.
277. Amendment 25-46, Effective December 1, 1978.
278 - 300. [RESERVED]

Go to SECTION 25.805 FLIGHT CREW EMERGENCY EXITS

301. Regulation in Effect at Adoption of Part 25.
302 - 320. [RESERVED]

Go to SECTION 25.807 PASSENGER EMERGENCY EXITS

321. Regulation in Effect at Adoption of Part 25.
322. Amendment 25-15, Effective October 24, 1967.
323. Amendment 25-32, Effective May 1, 1972.
324. Amendment 25-39, Effective February 10, 1977.
325. Amendment 25-46, Effective February 11, 1978.
326. Amendment 25-55, Effective April 28, 1982.
327 Amendment 25-67, Effective July 24, 1989
328 - 350. [RESERVED]

Go to SECTION 25.809 EMERGENCY EXIT ARRANGEMENT

351. Regulation in Effect at Adoption of Part 25.
352. Amendment 25-1, Effective June 7, 1965.
353. Amendment 25-9, Effective June 30, 1966.
354. Amendment 25-15, Effective October 24, 1967.
355. Amendment 25-32, Effective May 1, 1972.
356. Amendment 25-34, Effective December 31, 1972.
357. Amendment 25-46, Effective December 1, 1978.
358. Amendment 25-47, Effective December 24, 1979.
359 - 380. [RESERVED]

Go to SECTION 25.811 EMERGENCY EXIT MARKING

381. Regulation in Effect at Adoption of Part 25.
382. Amendment 25-1, Effective June 7, 1965.
383. Amendment 25-15, Effective October 24, 1967.
384. Amendment 25-32, Effective May 1, 1972.
385. Amendment 25-46, Effective December 1, 1978.
386-390. [RESERVED]

Go to SECTION 25.812 EMERGENCY LIGHTING

391. Section 25.812 Did Not Exist Prior to Amendment 25-15.
392. Amendment 25-15, Effective October 24, 1967.
393. Amendment 25-28, Effective September 25, 1971.
394. Amendment 25-32, Effective May 1, 1972.
395. Amendment 25-46, Effective December 1, 1978.
396. Amendment 25-58, Effective November 26, 1984.
397 - 410. [RESERVED]

Go to SECTION 25.813 EMERGENCY EXIT ACCESS

411. Regulation in Effect at Adoption of Part 25.
412. Amendment 25-1, Effective June 7, 1965.
413. Amendment 25-15, Effective October 24, 1967.
414. Amendment 25-17, Effective June 20, 1968.

415. Amendment 25-32, Effective May 1, 1972.
416. Amendment 25-46, Effective December 1, 1978.
417 - 440. [RESERVED]

Go to SECTION 25.815 WIDTH OF MAIN AISLE

441. Regulation in Effect at Adoption of Part 25.
442. Amendment 25-15, Effective October 24, 1967.
443. Amendment 25-38, Effective February 1, 1977.
444 - 460. [RESERVED]

Go to SECTION 25.817 MAXIMUM NUMBER OF SEATS ABREAST

461 Section 25.817 Did Not Exist Prior to Amendment 25-15
462 Amendment 25-15, Effective October 24, 1967
463 - 480. [RESERVED]

Go to SECTION 25.819 LOWER DECK SERVICE COMPARTMENTS (INCLUDING GALLEYS)

481. Section 25.819 Did Not Exist Prior to Amendment 25-53.
482. Amendment 25-53, Effective August 31, 1980.
483 - 600. [RESERVED]

Go to SECTION 25.851 FIRE EXTINGUISHERS

601. Regulation in Effect at Adoption of Part 25.
602. Amendment 25-54, Effective October 14, 1980.
603 - 620. [RESERVED]

Go to SECTION 25.853 COMPARTMENT INTERIORS

621. Regulation in Effect at Adoption of Part 25.
622. Amendment 25-15, Effective October 24, 1967.
623. Amendment 25-17, Effective June 20, 1968.
624. Amendment 25-23, Effective May 8, 1970.
625. Amendment 25-32, Effective May 1, 1972.
626. Amendment 25-51, Effective March 6, 1980.
627. Amendment 25-59, Effective November 26, 1984.
628 Amendment 25-60, Effective June 16, 1986
629 Amendment 25-61, Effective August 20, 1986
630 Amendment 25-66, Effective September 26, 1988
631 - 650. [RESERVED]

Go to SECTION 25.855 CARGO AND BAGGAGE COMPARTMENTS

651. Regulation in Effect at Adoption of Part 25.
652. Amendment 25-15, Effective October 24, 1967.
653. Amendment 25-32, Effective May 1, 1972.
654 Amendment 25-60, Effective June 16, 1986
655 - 670. [RESERVED]

Go to SECTION 25.857 CARGO COMPARTMENT CLASSIFICATION

671. Regulation in Effect at Adoption of Part 25.
672. Amendment 25-32, Effective May 1, 1972.
673 Amendment 25-60, Effective June 16, 1986
674 - 750. [RESERVED]

Go to SECTION 25.1307 MISCELLANEOUS EQUIPMENT

751. Regulation in Effect at Adoption of Part 25.
752. Amendment 25-23, Effective May 8, 1970.
753. Amendment 25-46, Effective December 1, 1978.
754. Amendment 25-54, Effective October 14, 1980.
755 - 780. [RESERVED]

Go to SECTION 25.1359 ELECTRICAL SYSTEM FIRE AND SMOKE PROTECTION

781. Section 25.1359(d) Did Not Exist Prior to Amendment 25-32.
782. Amendment 25-32, Effective May 1, 1972.
783 - 800. [RESERVED]

Go to SECTION 25.1411 SAFETY EQUIPMENT - GENERAL

801. Regulation in Effect at Adoption of Part 25.
802. Amendment 25-32, Effective May 1, 1972.
803. Amendment 25-46, Effective December 1, 1978.
804. Amendment 25-53, Effective August 31, 1980.
805 Amendment 25-70, Effective November 27, 1989
806 - 820. [RESERVED]

Go to SECTION 25.1413 SAFETY BELTS

821. Regulation in Effect at Adoption of Part 25.
822. Amendment 25-44, Effective December 4, 1978.
823. Amendment 25-51, Effective March 8, 1980.
824 - 840. [RESERVED]

Go to SECTION 25.1415 DITCHING EQUIPMENT

841. Regulation in Effect at Adoption of Part 25.
842. Amendment 25-29, Effective October 21, 1971.
843. Amendment 25-52, Effective September 9, 1980.
844 - 880. [RESERVED]

Go to SECTION 25.1421 MEGAPHONES

881 Section 25.1421 Did Not Exist Prior to Amendment 25-41
882 Amendment 25-41, Effective September 1, 1977
883 - 907. [RESERVED]

Go to SECTION 25.1423(g) PUBLIC ADDRESS SYSTEMS

908 Section 25.1423 Did Not Exist Prior to Amendment 25-70
909 Amendment 25-70, Effective November 27, 1989
910 - 920 [RESERVED]

Go to SECTION 25.1439(a) PROTECTIVE BREATHING EQUIPMENT

921 Regulation in Effect at Adoption of Part 25
922 Amendment 25-38, Effective February 1, 1977
923 - 970. [RESERVED]

Go to SECTION 25.1447 EQUIPMENT STANDARDS FOR OXYGEN DISPENSING UNITS

971. Regulation in Effect at Adoption of Part 25.
972. Amendment 25-41, Effective September 1, 1977.
973 - 1010. [RESERVED]

Go to SECTION 25.1451 FIRE PROTECTION FOR OXYGEN EQUIPMENT

1011. Regulation in Effect at Adoption of Part 25.
1012 - 1040. [RESERVED]

Go to SECTION 25.1541 MARKINGS AND PLACARDS - GENERAL

1041. Regulation in Effect at Adoption of Part 25.
1042 - 1060. [RESERVED]

Go to SECTION 25.1557(a), (c), and (d) MISCELLANEOUS MARKINGS AND PLACARDS

11. REGULATION IN EFFECT AT ADOPTION OF PART 25.

a. Regulation.

(a) The airplane, although it may be damaged in emergency landing conditions on land or water, must be designed as prescribed in this section to protect each occupant under those conditions.

(b) The structure must be designed to give each occupant every reasonable chance of escaping serious injury in a minor crash landing when--

(1) Proper use is made of seats, belts, and all other safety design provisions;

(2) The wheels are retracted (where applicable); and

(3) The occupant experiences the following ultimate inertia forces relative to the surrounding structure:

(i) Upward--2.0 g.

(ii) Forward--9.0 g.

(iii) Sideward--1.5 g.

(iv) Downward--4.5 g, or any lesser force that will not be exceeded when the airplane absorbs the landing loads resulting from impact with an ultimate descent velocity of five f.p.s. at design landing weight.

(c) The supporting structure must be designed to restrain, under all loads up to those specified in paragraph (b) (3) of this section, each item of mass that could injure an occupant if it came loose in a minor crash landing.

b. Guidance. There is no guidance for this regulation.

12. AMENDMENT 25-23, Effective May 8, 1970

a. Change to Regulation

(b)(3) The occupant experiences the following ultimate inertia forces acting separately relative to the surrounding structure:

b. Guidance. There is no guidance at this amendment.

13. AMENDMENT 25-64, Effective June 16, 1988

a. Change to Regulation.

(b)(3)(i) Upward, 3.0g

(ii) Forward, 9.0g

(iii) Sideward, 3.0g on the airframe; and 4.0g on the seats and their attachments.

(iv) Downward, 6.0g

(v) Rearward, 1.5g

(d) Seats and items of mass (and their supporting structure) must not deform under any loads up to those specified in paragraph (b)(3) of this section in any manner that would impede subsequent rapid evacuation of occupants.

b. Guidance. There is no guidance at this amendment.

14 - 20 [RESERVED]

SECTION 25.562 EMERGENCY LANDING DYNAMIC CONDITIONS

21. Section 25.562 Did Not Exist Prior to Amendment 25-64.

22. AMENDMENT 25-64, Effective June 16, 1988

a. Regulation.

(a) The seat and restraint system in the airplane must be designed as prescribed in this section to protect each occupant during an emergency landing condition when--

(1) Proper use is made of seats, safety belts, and shoulder harnesses provided for in the design; and

(2) The occupant is exposed to loads resulting from the conditions prescribed in this section.

(b) Each seat type design approved for crew or passenger occupancy during takeoff and landing must successfully complete dynamic tests or be demonstrated by rational analysis based on dynamic tests of a similar type seat, in accordance with each of the following emergency landing conditions. The tests must be conducted with an occupant simulated by a 170-pound anthropomorphic test dummy, as defined by 49 CFR Part 572, Subpart B, or its equivalent, sitting in the normal upright position.

(1) A change In downward vertical velocity (ΔV) of not less than 35 feet per second, with the airplane's longitudinal axis canted downward 30 degrees with respect to the horizontal plane and with the wings level. Peak floor deceleration must occur in not more than 0.08 seconds after impact and must reach a minimum of 14g.

(2) A change in forward longitudinal velocity (ΔV) of not less than 44 feet per second, with the airplane's longitudinal axis horizontal and yawed 10 degrees either right or left, whichever would cause the greatest likelihood of the upper torso restraint system (where installed) moving off the occupant's shoulder, and with the wings level. Peak floor deceleration must occur in not more than 0.09 seconds after impact and must reach a minimum of 16g. Where floor rails or floor fittings are used to attach the seating devices to the test fixture, the rails or fittings must be misaligned with respect to the adjacent set of rails or fittings by at least 10 degrees vertically (i.e., out of Parallel) with one rolled 10 degrees.

(c) The following performance measures must not be exceeded during the dynamic tests conducted in accordance with paragraph (b) of this section:

(1) Where upper torso straps are used for crewmembers, tension loads in individual straps must not exceed 1,750 pounds. If dual straps are used for restraining the upper torso, the total strap tension loads must not exceed 2,000 pounds.

(2) The maximum compressive load measured between the pelvis and the lumbar column of the anthropomorphic dummy must not exceed 1,500 pounds.

(3) The upper torso restraint straps (where installed) must remain on the occupant's shoulder during the impact.

(4) The lap safety belt must remain on the occupant's pelvis during the impact.

(5) Each occupant must be protected from serious head injury under the conditions prescribed in paragraph (b) of this section. Where head contact with seats or other structure can occur, protection must be provided so that the head impact does not exceed a Head Injury Criterion (HIC) of 1,000 units. The level of HIC is defined by the equation:

$$HIC = \left[(t_2 - t_1) \left[\frac{1}{(t_2 - t_1)} \int_{t_1}^{t_2} a(t)\, dt \right]^{2.5} \right]_{max}$$

Where:

t_1 is the initial integration time,
t_2 is the final integration time, and
a(t) is the total acceleration vs. time-curve for the head strike, and where (t) is in seconds, and (a) is in units of gravity (g).

(6) Where leg injuries may result from contact with seats or other structure, protection must be provided to prevent axially compressive loads exceeding 2,250 pounds in each femur.

(7) The seat must remain attached at all points of attachment, although the structure may have yielded.

(8) Seats must not yield under the tests specified in paragraphs (b)(1) and (b)(2) of this section to the extent they would impede rapid evacuation of the airplane occupants.

b. Guidance. See AC 25.562-1A, Dynamic Evaluation of Seat Restraint Systems & Occupant Protection on Transport Airplanes.

23 - 40 [RESERVED]

SECTION 25.772 PILOT COMPARTMENT DOORS

41. Section 25.772 Did Not Exist Prior to Amendment 25-33.

42. AMENDMENT 25-33, Effective October 21, 1972.

a. Regulation.

(a) Except as provided in paragraph (b) of this section, if a lockable door is installed between the pilot compartment and the passenger compartment to comply with § 121.313(f) of this chapter, the emergency exit configuration of the airplane must be designed so that neither crewmembers nor passengers need use that door in order to reach the emergency exits provided for them.

(b) The provisions of paragraph (a) of this section do not apply to an airplane that--

(l) Has a maximum passenger seating configuration of 20 seats or less; or

(2) Is excepted from the equipment requirements of § 121.313(f) under the provisions of § 121.583(a) of this chapter.

b. Guidance. There is no guidance for this regulation.

43. AMENDMENT 25-47, Effective December 24, 1979.

a. Change to Regulation.

(a) Except as provided in paragraph (b) of this section, if a lockable door is installed between the pilot compartment and the passenger compartment to comply with § 121.313(f) of this chapter, the emergency exit configuration of the airplane must be designed so that neither crewmembers nor passengers need use that door in order to reach the emergency exits provided for them. However, for passenger configuration, means must be provided to enable flight crewmembers to directly enter the passenger compartment from the pilot compartment if the cockpit door becomes jammed.

b. Guidance.

(1) Paragraph (a). Compliance may be shown by either analysis or demonstration.

(2) Paragraph (a). Acceptance of Frangible Doors. The following test procedure is acceptable to demonstrate that the door between the pilot compartment and the passenger compartment will not block the flight crewmembers' escape in the event the door is jammed. An acceptable means of showing compliance is by demonstrating that the door is frangible and the flightcrew participants can rapidly egress from the pilot compartment without assistance.

(i) The test should be conducted in an airplane, or a mockup if the mockup conforms to the production airplane's interior configuration. If a mockup is used, it should include the observer's seat(s), if they are part of the type design, and the bulkhead and door to be tested. The door should be blocked to simulate possible jamming from the top, bottom, and sides (closing and locking alone may not be adequate to simulate all possible jamming). If the fragments from the broken door could cause an obstruction to the escape routes for passenger emergency egress, and if an emergency evacuation demonstration is required by airworthiness regulations or operating rules, consideration should be given to include the passengers in the test. For emergency evacuation demonstrations with passengers, refer to § 25.803(c), Amendment 25-15.

(ii) Two participants representing a pilot in the left crew seat and a copilot in the right crew seat should be used for the test. They should be persons with no special escape abilities. The crewmembers should be a female approximately 60 inches tall and weighing no more than 102 pounds and a male approximately 74 inches tall and weighing no less than 210 pounds. The foregoing statures and weights represent the 5 and 95 percentiles respectively. The female participant will be instructed to break the door and be the first person to egress without assistance from the male participant. Instructions for enhancing the egress should be limited to those instructions that will be provided in the FAA-approved Airplane Flight Manual (AFM) or on the related placards.

(iii) The test should be conducted in night conditions. If conducted in a hangar during the day, the hangar should be draped and taped so that all sunlight is prevented from entering the hangar. Similar conditions should exist if conducted at night either in or out of a hangar. Lighting may be allowed at ground level to aid in leaving the area near the airplane providing the lighting is kept low and shielded so it does not aid evacuating the airplane. Use of emergency lighting is acceptable.

(iv) Personnel participating should be informed of the purpose of the demonstration and of the safety precautions. Safety of participants is the responsibility of the applicant, and should be considered to prevent injuries to the participants without compromising the test results. Participants may wear protective gear such as crash helmets, but the protective gear, tools, or any other device should not be used to break through the door.

44 - 60. [RESERVED]

SECTION 25.783 DOORS

61. REGULATION IN EFFECT AT ADOPTION OF PART 25.

a. Regulation.

(a) Each cabin must have at least one easily accessible external door.

(b) There must be a means to lock and safeguard each external door against opening in flight (either inadvertently by persons or as a result of mechanical failure). Each external door must be openable from both the inside and the outside, even though persons may be crowded against the door on the inside of the airplane. Inward opening doors may be used if there are means to prevent occupants from crowding against the door to an extent that would interfere with the opening of the door. The means of opening must be simple and obvious and must be arranged and marked so that it can be readily located and operated, even in darkness. Auxiliary locking devices may be used.

(c) Each external door must be reasonably free from jamming as a result of fuselage deformation in a minor crash.

(d) Each external door must be located where persons using them will not be endangered by the propellers when appropriate operating procedures are used.

(e) There must be a provision for direct visual inspection of the locking mechanism by crewmembers to determine whether external doors, for which the initial opening movement is outward (including passenger, crew, service, and cargo doors), are fully locked. In addition, there must be a visual means to signal to appropriate crewmembers when normally used external doors are closed and fully locked.

(f) Cargo and service doors not suitable for use as an exit in an emergency need only meet paragraph (e) of this section and be safeguarded against opening in flight as a result of mechanical failure.

b. Guidance.

(l) Paragraphs (b) through (e). The requirements of these paragraphs apply to all cabin and pilot compartment external doors usable for entrance or egress. It is not restricted to the main cabin door. Cargo and service doors not suitable for emergency egress need only comply with § 25.783(e) and be safeguarded against opening in flight as a result of mechanical failure.

(2) Paragraph (b). Auxiliary locking devices.

(i) The use of auxiliary locking devices is permitted. Such devices would include dual locking handles, other types of locking and safety devices, two position handles, and dual operation handles (where one operation such as pushing or pulling on the handle unlocks the latching mechanism and the second operation of turning the handle unlatches the door for opening). Auxiliary locking devices should be used only as an additional safety factor and should not be used as a means of correcting an inadequate design of the primary locking or latching means. The advantages to be gained from the installation of auxiliary or dual locking devices (safety chains and dual handle main locking means) should be weighed against the need to easily and rapidly open the door in case of emergencies so that the overall level of safety is as high as practicable.

(ii) All locking or safety means, including safety chains and latches of any kind, should be so positioned and designed that their presence, location and means of operation are obvious to one not familiar with door designs.

(A) The means of fastening safety devices should be sufficiently simple to make removal easy.

(B) Any emergency release mechanism installed to release the safety device should operate with a simple motion and upon the application of relatively small forces.

(C) All locking devices should be readily operable from both inside and outside of the airplane and be appropriately marked both inside and outside.

(iii) Auxiliary safety devices meeting the standards of paragraph (ii) above may be fastened in place during the entire flight. It will not be necessary to have such devices unlatched during takeoff and landing. Auxiliary safety devices such as safety chains or bars that do not meet the standards of paragraph (ii) above may be used provided operating instructions are installed at or near the device and a placard is installed requiring the removal of such devices prior to takeoff and landing. For related guidance, see paragraph 351b(2).

(3) Paragraph (b). Power operated external doors. Power operated doors should be so designed that the door can be opened by manual means even when power is inactivated. The loss of power should not cause the door to become unlatched. Since emergency landings, such as the wheels-up condition, may result in the severance of electrical wires or rupture of hydraulic and pneumatic lines, the power which may be needed for operation of the doors or exits may be lost. Similarly, it is conceivable that under emergency conditions, the electrical power source may be purposely interrupted to reduce the possibility of fire.

(4) Paragraphs (b) and (e). Means for safeguarding against inadvertent opening in flight. Auxiliary locking devices may be used to reduce the probability of inadvertent opening in flight provided they meet the standards and conditions covered above.

(i) It is acceptable to create a limited access zone in front of the door to eliminate the possibility of a passenger using the door handle as a steadying means and thereby

inadvertently opening the door. Although providing a restricted zone by means of a barrier may appear to conflict with the requirements of § 25.813 for an unobstructed passageway to Type I and II emergency exits, it is considered that it would contribute sufficiently to the overall safety of the airplane occupants to be permitted. This device may be a rope, chain, rigid bar or gate. Such installations should be waist high to provide the maximum benefits for an adult and the end fastenings should be simple to make removal easy. It is not considered acceptable to install full-length auxiliary doors, but waist-high rigid gates would be acceptable provided they open toward the door and will not block the opening of the cabin door in any way. The locking means should be one which could be easily overridden such as a spring-loaded ball type latch.

(ii) Flexible gates such as those made from webbing are not acceptable on the basis that persons may become entangled during an emergency egress. The use of a barrier to prevent persons from inadvertently opening the door in flight does not eliminate the need for a safety means to provide for possible malfunctioning of the primary locking mechanism; however, the auxiliary safetying means covered above may eliminate the need for a restricted zone.

(5) Paragraph (e). Direct visual inspection. The means of complying with paragraph (e) of this section will depend upon the type of door and locking mechanism used. In all cases there should be provisions to ascertain that an unsatisfactory condition does not exist after closing the door. In some instances a central window for viewing the position of the mechanism may be sufficient while other cases may require one or more windows in the door frame to permit inspection of the bayonet location relative to that portion of the lock in the door frame. The need for or the number and location of inspection openings or windows will depend on the type of door and locking mechanism used.

(6) Paragraph (e). Visual indicating system. The objective herein is to be able to ascertain by visual means that the door or locking means is sufficiently engaged to eliminate hazards emanating from an improperly closed door. Outward opening doors present a different problem from inward opening doors.

(i) The visual indicating system may consist of an indicator for each individual door, or a system connecting all doors in series. If the latter system is used, it need not necessarily show which door is not fully locked.

(ii) It is not necessary that more than one crewmember be able to ascertain by a visual signal that all external doors, normally used by the crew in supplying the airplane, or in loading and unloading passengers and cargo, are fully closed and locked. The visual signal should be located so that it may easily be seen by the appropriate crewmember from his station.

62. AMENDMENT 25-15, Effective October 24, 1967.

a. Change to Regulation.

> (g) Each passenger entry door in the side of the fuselage must qualify as a Type A, Type I, or Type II passenger emergency exit and must meet the requirements of § 25.807 through § 25.813 that apply to that type of passenger emergency exit. If an integral stair is installed at such a

passenger entry door, the stair must be designed so that when subjected to the inertia forces specified in § 25.561, and following the collapse of one or more legs of the landing gear, it will not interfere to an extent that will reduce the effectiveness of emergency egress through the passenger entry door.

b. Guidance. There is no additional guidance for this amendment.

63. AMENDMENT 25-23, Effective May 8, 1970.

a. Change to Regulation.

(b) There must be a means to lock and safeguard each external door against opening in flight (either inadvertently by persons or as a result of mechanical failure or failure of a single structural element). Each external door must be openable from both the inside and the outside, even though persons may be crowded against the door on the inside of the airplane. Inward opening doors may be used if there are means to prevent occupants from crowding against the door to an extent that would interfere with the opening of the door. The means of opening must be simple and obvious and must be arranged and marked so that it can be readily located and operated, even in darkness. Auxiliary locking devices may be used.

(f) Cargo and service doors not suitable for use as an exit in an emergency need only meet paragraph (e) of this section and be safeguarded against opening in flight as a result of mechanical failure or failure of a single structural element.

b. Guidance. There is no additional guidance for this amendment.

64. AMENDMENT 25-54, Effective October 14, 1980.

a. Change to Regulation.

(b) There must be a means to lock and safeguard each external door against opening in flight (either inadvertently by persons or as a result of mechanical failure or failure of a single structural element either during or after closure). Each external door must be openable from both the inside and the outside, even though persons may be crowded against the door on the inside of the airplane. Inward opening doors may be used if there are means to prevent occupants from crowding against the door to an extent that would interfere with the opening of the door. The means of opening must be simple and obvious and must be arranged and marked so that it can be readily located and operated, even in darkness. Auxiliary locking devices may be used.

(e) There must be a provision for direct visual inspection of the locking mechanism to determine if external doors, for which the initial opening movement is not inward (including passenger, crew, service, and cargo doors), are fully closed and locked. The provision must be discernible under operational lighting conditions by appropriate crewmembers using a flashlight or equivalent lighting source. In addition, there must be a visual warning means to signal the appropriate flight crewmembers if any external door is not fully closed and locked. The means must be designed such that any failure or combination of failures that would result in an erroneous closed and locked indication is improbable for doors for which the initial opening movement is not inward.

(f) External doors must have provisions to prevent the initiation of pressurization of the airplane to an unsafe level if the door is not fully closed and locked. In addition, it must be shown by safety analysis that inadvertent opening is extremely improbable.

(g) Cargo and service doors not suitable for use as an exit in an emergency need only meet paragraph (e) of this section and be safeguarded against opening in flight as a result of mechanical failure or failure of a single structural element.

(h) Each passenger entry door in the side of the fuselage must qualify as a Type A, Type I, or Type II passenger emergency exit and must meet the requirements of § 25.807 through § 25.813 that apply to that type of passenger emergency exit.

(i) If an integral stair is installed in a passenger entry door that is qualified as a passenger emergency exit, the stair must be designed so

that under the following conditions the effectiveness of passenger emergency egress will not be impaired:

(l) The door, integral stair, and operating mechanism have been subjected to the inertia forces specified in § 25.561(b)(3), acting separately relative to the surrounding structure.

(2) The airplane is in the normal ground attitude and in each of the attitudes corresponding to collapse of one or more legs of the landing gear.

(j) All lavatory doors must be designed to preclude anyone from becoming trapped inside the lavatory, and if a locking mechanism is installed, it be capable of being unlocked from the outside without the aid of special tools.

b. Guidance.

(1) See § 25.809 for related requirements, and AC 25.783-1, Fuselage Doors, Hatches, and Exits, for related guidance.

(2) Protection against inadvertent exit door openings is required, but at the same time, a single-motion handle operation to open a passenger door should be provided to facilitate emergency egress. Auxiliary locking devices that complicate the door opening process may be accepted as necessary, though undesirable, only if it can be substantiated that there is no other practicable means of protecting against inadvertent exit door opening.

Auxiliary locking devices that may initially be assumed to be necessary, in fact might be eliminated by assuring that the door is designed in accordance with elementary human factors principles. A door that is opened by moving a handle from the up position to a down position represents a design contrary to the convention believed to be familiar to most people in the aircraft industry, and thus may lend itself to contributing to an inadvertent door opening, as has actually happened. In addition, a door handle that is in the up position when the door is closed lends itself to more easily being used as a handhold in flight, which may result in an inadvertent opening. Obviously, the threat inherent in this design would practically mandate the inclusion of auxiliary locking devices, to the possible detriment of emergency egress capability. On the other hand, a door handle which operates in a conventional manner (i.e., moves up to open, moves down to close) is not as prone to inappropriate operation, nor is it in a location as susceptible for use as a handhold in flight. Consequently, this design, in addition to being more user-friendly from a human factors viewpoint, may eliminate any need for auxiliary locking devices as well, and should, therefore, be the solution considered to be most consistent with FAA requirements.

Handles which operate in a rotary manner (in a plane parallel to that of the door) are not known to have been implicated in any incidents as noted above, nor has clockwise versus counterclockwise rotary motion been known to be controversial in this regard (except that counterclockwise may be the most universally accepted convention for opening jars, faucets, etc.). Likewise, these handles have not been considered to represent the attractive handhold

devices in flight that other types of handles might and, furthermore, they require a deliberate effort to actuate.

When it can be substantiated to the satisfaction of the FAA that auxiliary locking devices are necessary to comply with the inadvertent door opening requirements of §§ 25.783(a) and 25.809(f), and it is not through design defect that these devices are provided, any potentially adverse impact of these devices on emergency egress must be minimized through adherence to the available guidance pertinent to auxiliary locking devices. "Design defect" in this context may reasonably be considered to include designs which neglect to address known human factors concerns as highlighted herein. Auxiliary locking devices which are deemed to be not simple and obvious are not acceptable. Devices which are hidden by design or color, recessed, contoured, camouflaged, or otherwise concealed to the degree that a naive person may need to read a placard to determine how to open the door are not simple and obvious, and are therefore not acceptable. Suitable demonstrations may be required to substantiate acceptability in this regard.

65 - 80. [RESERVED]

SECTION 25.785 SEATS, BERTHS, SAFETY BELTS, AND HARNESSES

81. REGULATION IN EFFECT AT ADOPTION OF PART 25.

a. Regulation.

(a) Each seat, berth, safety belt, harness, and adjacent part of the airplane, at each station designated as occupiable during takeoff and landing, must be designed so that a person making proper use of these facilities will not suffer serious injury in an emergency landing as a result of the inertia forces specified in § 25.561.

(b) Each seat and berth must be approved.

(c) Each occupant must be protected from head injury by--

(l) A safety belt and shoulder harness that will prevent the head from contacting any injurious object;

(2) A safety belt plus the elimination of any injurious object within striking radius of the head; or

(3) Safety belt plus a cushioned rest that will support the arms, shoulders, head and spine.

(d) If the seat backs do not have a firm hand hold, there must be a hand grip or rail along each aisle to enable occupants to steady themselves while using the aisles in moderately rough air.

(e) Each projecting object that would injure persons seated or moving about the airplane in normal flight must be padded.

(f) Each berth must be designed so that the forward part has a padded end board, canvas diaphragm, or equivalent means that can withstand the static load reaction of the occupant when subjected to the forward inertia force specified in § 25.561. Berths must be free from corners and protuberances likely to cause serious injury to a person occupying the berth during emergency conditions.

(g) Each crewmember seat at flight deck stations must have provisions for a shoulder harness. These seats must meet strength requirements of paragraph (i) of this section.

(h) Cabin attendant seats must be in the passenger compartment near approved floor level emergency exits.

(i) Each seat, berth, and its supporting structure, must be designed for an occupant weight of 170 pounds, considering the maximum load factors, inertia forces, and reactions between the occupant, seat, and safety belt or harness, at each relevant flight and ground load condition (including the emergency landing conditions prescribed in § 25.561). For berths, the forward inertia force must be considered in accordance with paragraph (f) of this section and need not be considered with respect to the safety belt. In addition--

(l) The structural analysis and testing of the seats, berths, and their supporting structures may be determined by--

(i) Assuming that the critical load in the forward, sideward, downward, and rearward directions (as determined from the prescribed flight, ground, and emergency landing conditions) acts separately; and

(ii) Using selected combinations of loads if the required strength in each specified direction is substantiated;

(2) Each pilot seat must be designed for the reactions resulting from the application of the pilot forces prescribed in § 25.395; and

(3) The inertia forces specified in § 25.561 must be multiplied by a factor of l.33 (instead of the fitting factor prescribed in § 25.625) in determining the strength of the attachment of--

(i) Each seat to the structure; and

(ii) Each belt or harness to seat or structure.

b. Guidance.

(l) Paragraph (a). In order for the seat belt to be effective, it should be positioned to lay across the hip bone and ideally be about 45 degrees from the horizontal. An acceptable range for this angle is 35 degrees to 55 degrees. An acceptable range for the shoulder harness is 30 degrees above to 5 degrees below the horizontal. See AC's 25.785-1A and 43.13-1A, Acceptable Methods, Techniques, and Practices--Aircraft Inspection and Repair.

(2) Paragraph (c). For side facing seat installations, the following are satisfactory and do not need a shoulder harness:

(i) An unpadded bulkhead immediately adjacent to and forward of a normal width armrest.

(ii) Another occupant who serves as a "human cushion."

(3) Paragraph (c)(2). The striking radius of the head is considered to be an arc of 35 inches whose center is at the intersection of the plane of the uncompressed top of the seat cushion with the plane of the uncompressed front of the back cushion; commonly referred to as the seat reference point (SRP). The arc width is considered to extend to the centerlines of each armrest. Typical installations to be considered are bulkheads, cabinets, tables and passenger evacuation slide covers. If the sidewall configuration is such that it is potentially hazardous in a combination of forward and side loads, it should be substantiated even if it might be slightly outside of the centerline of the armrest. Any surface less than 18 inches above the floor need not be considered. Surfaces within the 35-inch arc may be padded with energy absorbing material, such as one inch of either Ensolite (Type AH or HH), Klegecell or Airex 4070. Foam rubber is not satisfactory since it is an energy storing material. If the padding is easily removed, there should be acceptable placarding requiring the padding be in place during taxi, takeoff and landing.

(4) Paragraph (c)(2). A flat surface within the 35" head strike arc, such as a table or partition, may be tested to the criteria of Society of Automotive Engineers (SAE) J921 or the following criteria. Impact injury criteria is discussed in AC 21-22, Injury Criteria for Human Exposure to Impact.

(i) A 13-lb.bowling ball may be used to simulate the head of a 170-pound person whose seat belt is fastened and is subjected to 9g.

(ii) The ball shall impact the surface with at least 2780 inch-pounds of energy.

(iii) The attachments of the test article shall not fail completely.

(iv) No parts shall become loose or sharp projections be formed that would be hazardous to the passengers.

(v) The test article may deform locally.

(vi) The surface being tested should perform equal or better to a previously approved surface.

(5) Paragraph (c)(2). (i) Some passenger seats are designed with armrests that pivot upward such that the armrest could protrude beyond the seatbacks resulting in a potentially hazardous condition to persons seated behind these seats. Armrests that are adequately delethalized or restricted such that they cannot protrude aft of either seatback in any position are acceptable.

(ii) Armrests that are offset can be within the headstrike path of an occupant to the rear, and should be delethalized if they are offset more than 2" from the armrests of the seat to the rear, or are on an exposed seat place, such that they are bounded on one side only.

(6) Paragraph (d). The seat back may serve as a firm hand hold. Since most seats are capable of breaking over, the breakover load must be adequate to be considered firm. A load of 25 pounds minimum, acting horizontally, is considered adequate when applied at the top center

of the seat back. (See paragraph 411b(8) for maximum breakover force.) Very large seat pitches (in excess of 65") may not permit the seatbacks to act as a handhold. This is due to both distance between the seatbacks and the capability of the seats to have very large amounts of recline. In this case, it may be necessary to install supplementary features to serve as handholds.

(7) Paragraph (f). Each berth installation should include a seat belt located approximately at the occupant's pelvis. For a berth installation with the feet facing forward, a bag, enclosing the legs to catch the upper torso when subjected to 9g, would be satisfactory in lieu of a padded end board. If the head is facing forward, a strap over each shoulder configuration would be satisfactory. If the berth is side facing, a padded side board or two belts, located approximately at the thighs and approximately at the chest, would be satisfactory.

(8) This requirement refers to cabin attendant seats that are provided, and should not be interpreted as a requirement for a cabin attendant seat to be installed at each floor level exit.

(9) Paragraph (i). In order to reduce the deceleration "g" forces on occupants, some forward facing seats are designed to collapse. Usually, the design incorporates collapsible front legs. Such is acceptable if the collapse does not occur until a minimum of 8g has been applied. After the collapse has occurred, the ultimate load of 9g should be applied and maintained for the required three seconds. The activation of the energy absorbing feature should not result in occupant injury. Various dimensions, such as 35 inches to injurious object clearance, aisle width and clearance, and interference with exits, should be evaluated before and after activation of the energy absorbing feature. Required dimensional clearances, such as aisles, passageways, flight attendant assist spaces, exit opening envelopes, and clearance between seats and potentially injurious surfaces must be maintained after the energy-absorbing feature is activated. The final position of the seat should not trap occupants.

(10) Paragraph (i). Technical Standard Order (TSO)-C22 is applicable only to seat belts. Technical Standard Order C114 may be applicable to shoulder harnesses, or they may be approved as part of the airplane. Sled tests with anthropomorphic dummies have shown that shoulder harness loads for forward facing seats can vary between 40 percent and 60 percent of the total load. Therefore, it will be acceptable to substantiate a shoulder harness load of 60 percent (See AC 25.785-1, Flight Attendant Seat Requirements): 0.6x9gx170 pounds = 918 pounds. If the seat belt is not approved under TSO-C22 or later revision, it should be approved as part of the airplane. The seat belt should be substantiated for 100 percent of the occupant load:
9g x 170 pounds = 1530 pounds. This is necessary even if the shoulder harness is permanently attached to the seat belt, since it is usually possible to utilize the seat belt without using the shoulder harness. The l.33 fitting factor is applicable to these configurations.

(11) Paragraph (i)(1)(i). A seat is normally approved to TSO-C39 or later revision. This approval may not account for the critical load when occupied by less than maximum occupants, e.g., one or two occupants in a triple seat. In some seat designs, occupancy by less than the maximum could be a critical design load for a particular structural member. All possible combinations of seat place occupancy should be substantiated by test or analysis. The loads for underseat baggage restraint systems attached to the seat should be added to seat loads. See

§ 25.787 guidance for underseat baggage criteria. This can be done by the TSO manufacturer when doing the TSO substantiation or by the applicant who is installing the seat.

(12) Paragraph (i)(3). The l.33 factor is only required to be applied to the stated attachments. This factor should be applied to both ends of each attachment, i.e., the seat end and the airplane end. If the applicant wishes to test the entire seat and belt assembly to this l.33 factor, it is satisfactory.

82. AMENDMENT 25-15, Effective October 24, 1967.

a. Change to Regulation.

> (c) Each occupant of a sideward facing seat must be protected from head injury by a safety belt and an energy absorbing rest that will support the arms, shoulders, head, and spine, or by a safety belt and a shoulder harness that will prevent the head from contacting any injurious object. Each occupant of any other seat must be protected from head injury by--
>
> (l) A safety belt and shoulder harness that will prevent the head from contacting any injurious object;
>
> (2) A safety belt plus the elimination of any injurious object within striking radius of the head; or
>
> (3) A safety belt and an energy absorbing rest that will support the arms, shoulder, head, and spine.

b. Guidance. Paragraph (c). For sideward facing seats, this change removed the option of a safety belt plus eliminated any injurious object from within striking radius of the head. This option is still satisfactory for forward and aft facing seats. The "human cushion" or unpadded bulkhead concept is not an adequate energy absorbing rest and therefore does not comply with this version of the regulation. The shoulder harness may be a diagonal shoulder harness over the forward shoulder.

83. AMENDMENT 25-20, Effective April 23, 1969.

a. Change to Regulation.

(c) Each occupant of a seat that makes more than an 18-degree angle with the vertical plane containing the airplane centerline, must be protected from head injury by a safety belt and an energy absorbing rest that will support the arms, shoulders, head, and spine, or by a safety belt and shoulder harness that will prevent the head from contacting any injurious object. Each occupant of any other seat must be protected from head injury by--

b. Guidance. Paragraph (c). The 18-degree requirement applies to both forward and aft facing seat installations. If the forward direction is considered as 0 degrees or 360 degrees of a circle, the segments from 18 degrees to 162 degrees and 198 degrees to 342 degrees are

considered a side facing seat and the seat installation must comply with one of the two options stated in the regulation.

84. AMENDMENT 25-32, Effective May l, 1972.

a. Change to Regulation.

> (c) Each occupant of a seat that makes more than an 18-degree angle with the vertical plane containing the airplane centerline, must be protected from head injury by a safety belt and an energy absorbing rest that will support the arms, shoulders, head, and spine, or by a safety belt and shoulder harness that will prevent the head from contacting any injurious object. Each occupant of any other seat must be protected from head injury by a safety belt and, as appropriate to the type, location, and angle of facing of each seat, by one or more of the following:
>
> (l) A shoulder harness that will prevent the head from contacting any injurious object.
>
> (2) The elimination of any injurious object within striking radius of the head.
>
> (3) An energy absorbing rest that will support the arms, shoulders, head, and spine.

b. Guidance. There is no additional guidance for this amendment.

85. AMENDMENT 25-51, Effective March 6, 1980.

a. Change to Regulation.

(g) Each seat at a flight deck station must have a combined safety belt and shoulder harness with a single-point release that permits the flight deck occupant, when seated with safety belt and shoulder harness fastened, to perform all of the occupant's necessary flight deck functions. There must be a means to secure each combined safety belt and shoulder harness, when not in use, to prevent interference with the operation of the airplane and with rapid egress in an emergency.

> (h) Flight attendant seats in passenger compartments must be near required floor level emergency exits and be equipped with a restraint system consisting of a combined safety belt and shoulder harness unit with a single-point release. There must be means to secure each combined safety belt and shoulder harness, when not in use, to prevent interference with rapid egress in an emergency. In addition--
>
> (l) To the extent possible without compromising their proximity to required floor level emergency exits, flight attendant seats must be

located to provide a direct view of the cabin area for which the flight attendant is individually responsible.

(2) Flight attendant seats must--

(i) Either be forward or rearward facing, with an energy absorbing rest that is designed to support the arms, shoulders, head and spine; and

(ii) Be positioned so that when not in use they will not interfere with the use of passageways and exits.

(i) each seat, berth, and its supporting structure must be designed for an occupant weight of 170 pounds, considering the maximum load factors, inertia forces, and reactions between the occupant, seat, and safety belt, harness or both at each relevant flight and ground load condition (including the emergency landing conditions prescribed in § 25.561). For berths, the forward inertia force must be considered in accordance with paragraph (f) of this section and need not be considered with respect to the safety belt. In addition--

(j) Each flight attendant seat must be located to minimize the probability of its occupant suffering injury by being struck by items dislodged in a galley, or from a stowage compartment or serving cart. All items expected in these locations in service must be considered.

(k) Each forward observer's seat required by the operating rules must be shown to be suitable for use in conducting the enroute inspections prescribed by § 121.581(a).

b. Guidance.

(l) Paragraphs (g) and (h). The combined safety belt and shoulder harness should consist of a standard safety belt and a shoulder harness with a strap over each shoulder. The shoulder harness straps should be as close to the neck as possible and may join behind the neck or each strap may attach separately to structure. In the front, the shoulder harness straps should attach to the buckle or safety belt near the buckle. Some harness geometries have been found acceptable where the shoulder harness straps are attached to the seat belt attach fittings. Ideally, the buckle should be located near the center of the torso. The single point release should be one action in which both the safety belt and shoulder harness are released simultaneously. The means provided to secure each combined safety belt and harness should be designed so that the belt and harness strap material does not get repeatedly creased over a long period of wear.

(2) Paragraphs (g), (h) and (j). See AC 25.785-lA, Flight Attendant Seat and Torso Restraint System Requirements, for additional acceptable means of compliance.

86. AMENDMENT 25-64, Effective June 16, 1988.

a. Change to Regulation.

(a) Each seat, berth, safety belt, harness, and adjacent part of the airplane at each station designated as occupiable during takeoff and landing must be designated so that a person making proper use of these facilities will not suffer serious injury in an emergency landing as a result of inertia forces specified in §§ 25.561 and 25.562.

b. Guidance.

(1)See Advisory Circular 25.562-1A for detailed guidance concerning this amendment.

(2) Compliance with § 25.785(a) can be demonstrated using the tests required by § 25.562(b), and showing compliance with the associated injury criteria, for those objects that are assessed in those tests. However, because the tests specified in §25.562 are limited to certain conditions, they may not address all areas that could be injurious, either flight, or in an emergency landing. For this reason, simply showing that an object is outside the headstrike envelope produced in a dynamic test in accordance with § 25.562 is not sufficient to show compliance with 25.785(a). Objects may, in fact, require delethalization, even though they are not struck in a dynamic test.

87-100. [RESERVED]

SECTION 25.787 STOWAGE COMPARTMENTS

101. REGULATION IN EFFECT AT ADOPTION OF PART 25.

a. Regulation.

(a) Each cargo and baggage compartment must be designed for its placarded maximum weight and contents and for the critical load distributions at the appropriate maximum load factors corresponding to the specified flight and ground load conditions, except the emergency landing conditions of § 25.561.

(b) There must be a means to prevent the contents in the compartments from becoming a hazard by shifting, under the loads specified in paragraph (a) of this section.

(c) There must be a means to protect the occupants from injury by the contents of any compartment, under the emergency landing conditions of § 25.561.

b. Guidance.

(1) Paragraph (a). Compartments placarded "No Stowage" need not have a weight limit placard. Compartments placarded "Emergency Equipment Only" need not have a weight limit placard provided the compartment is filled with designated emergency equipment that does not exceed the compartment's limit. (See paragraphs 801b(1)(ii), 1041b(5) and 1101b(2).)

(2) Paragraph (b). Baggage can be free if it can be shown that the forward barrier and cargo liner are able to restrain impact loads and the compartment is small enough to prevent significant shifts in center of gravity (c.g.). A 9g barrier net or other structure are required in all cargo versions if the cargo is not restrained to § 25.561 loads. In this case the cargo is restrained to flight and ground loads to prevent c.g. movement. If no 9g barrier net is used, the cargo is restrained to § 25.561 loads in an approved installation such as containers or pallets. (See paragraph 1041b(9).)

102. AMENDMENT 25-32, Effective May 1, 1972.

a. Change to Regulation.

(a) Each compartment for the stowage of cargo, baggage, carry-on articles, and equipment (such as life rafts), and any other stowage compartment must be designed for its placarded maximum weight of contents and for the critical load distribution at the appropriate maximum load factors corresponding to the specified flight and ground load conditions, and to the emergency landing conditions of § 25.561(b), except that the forces specified in the emergency landing conditions need not be applied to compartments located below, or forward, of all occupants in the airplane. If the airplane has a passenger seating configuration, excluding

pilots seats, of 10 seats or more, each stowage compartment in the passenger cabin, except for underseat and overhead compartments for passenger convenience, must be completely enclosed.

b. Guidance. Paragraph (c) was deleted with the adoption of § 25.789.

(1) The intent for requiring completely enclosed stowage compartments is to provide more protection to occupants than that provided by restraint devices such as tie-down straps or webbing (with or without a curtain).

(2) Standard design criteria for underseat baggage restraint. (These criteria can be used for test or analysis purposes.)

(i) Forward restraint design criteria.

(A) Load factor - 9g forward.

(B) Basic baggage weight - 20 pounds per individual seat.

(C) Bag dimension - 3 X 12 X 17 inches (assumed rigid).

NOTE: These dimensions represent what is considered the most severe case and are not to be construed as the maximum baggage size which should be considered. The restraint device should be capable of restraining baggage of a size which can be stowed under the seat in the available space, but the weight need not be more than 20 pounds.

(D) The bag surface upon which it rests should be assumed smooth so as to minimize any friction restraint.

(E) The load (20 X 9 = 180 pounds) should be assumed applied through the bag with the seat mounted in its normal position. The 17 X 3-inch bag dimension should impinge on the restraint device unless the underseat dimensions are such that the test bag would protrude beyond the seat. In that case the 3 X 12-inch dimension should be used.

(F) The critical load conditions for the underseat baggage restraints should be identified and demonstrated.

(G) The bottom of the restraint system should be no more than 2 1/2 inches above the floor level of the airplane. The top of the system should be no less than 3 inches above the floor level of the airplane.

(ii) Side restraining design criteria.

(A) The underseat baggage side restraint system should be capable of restraining a 20-pound rigid article per seat with the dimensions of 3 X 12 X 17 inches at 1.5g of side loading. (20 pounds X 1.5 g = 30 pounds per article.)

(B) The side restraint system should be capable of restraining the article at 1.5g sidewards with the 17-inch dimension oriented fore and aft in the airplane.

(C) If the restraint system allows application of a footload, the system should be capable of withstanding a 300-pound standing load, applied in the most critical mode, without degrading either the basic forward load carrying capability or the side load carrying capabilities noted above or resulting in deformation causing the system to pose a tripping hazard.

(D) The system should be capable of withstanding the most critical loading condition due to asymmetrical loading of the system.

(E) The bottom of the restraint system should be no more than 2 1/2 inches above the floor level of the airplane. The top of the system should be no less than 3 inches above the floor level of the airplane. The restraint system should extend a minimum of 8.75 inches aft from the aft face of the forward restraint portion of the system.

(F) The side restraint system should not present a tripping hazard either for ingress to the seat or egress to the aisle or to the evacuation route.

(G) The restraint system should not protrude into the aisle or evacuation route farther than the seat armrest on the aisle side.

(3) If overhead stowage compartments are intended for carriage of baggage, other than articles of loose clothing, they must be provided with approved restraining devices or doors (§ 121.589 (b)).

(4) Paragraph (a). The wording "a passenger seating configuration, excluding pilot seats, of 10 seats or more," which was promulgated with the intent of being consistent with Amendment 23-10 to part 23, does not directly address seats intended for use by observers or flight attendants. Seats approved for use by observers or flight attendants are not included in the passenger seating configuration.

103. AMENDMENT 25-38, Effective February 1, 1977.

a. Change to Regulation.

(c) If cargo compartment lamps are installed, each lamp must be installed so as to prevent contact between lamp bulb and cargo.

b. Guidance. There is no additional guidance for this amendment.

104. AMENDMENT 25-51, Effective March 6, 1980.

a. Change to Regulation.

> (b) There must be a means to prevent the contents in the compartments from becoming a hazard by shifting, under the loads specified in paragraph (a) of this section. For stowage compartments in the passenger and crew cabin, if the means used is a latched door, the design must take into consideration the wear and deterioration expected in service.

b. Guidance. The intent of the last sentence of paragraph (b) is to prevent inadvertent opening of the latched doors of stowage compartments by specifically requiring that service wear and deterioration be considered in the design. This is not the same as the § 25.789 requirement which is directed to retention of items of mass subjected to maximum load factors. The installation of acceptable dual latching devices, each of which can withstand the applicable loads, has been found to be one means to show compliance with this rule.

105 - 120. [RESERVED]

SECTION 25.789 RETENTION OF ITEMS OF MASS

121. Section 25.789 Did Not Exist Prior to Amendment 25-32.

122. AMENDMENT 25-32, Effective May 1, 1972.

a. Regulation.

> Means must be provided to prevent each item of mass (that is part of the airplane type design) in a passenger or crew compartment from becoming a hazard by shifting under the appropriate maximum load factors corresponding to the specified flight and ground load conditions, and to the emergency landing conditions of § 25.561(b).

b. Guidance. There is no guidance for this amendment.

123. AMENDMENT 25-46, Effective December 1, 1978.

a. Regulation.

> (a) Means must be provided to prevent each item of mass (that is part of the airplane type design) in a passenger or crew compartment or galley from becoming a hazard by shifting under the appropriate maximum load factors corresponding to the specified flight and ground load conditions, and to the emergency landing conditions of § 25.561(b).
>
> (b) Each interphone restraint system must be designed so that when subjected to the load factors specified in § 25.561(b)(3), the interior phone will remain in its stowed position.

b. Guidance. There is no guidance for this amendment.

124 -140. [RESERVED]

SECTION 25.791 PASSENGER INFORMATION SIGNS

141. Section 25.791 Did Not Exist Prior to Amendment 25-32.

142. AMENDMENT 25-32, Effective May 1, 1972.

a. Regulation.

> When passenger information signs are installed to comply with the operating rules of this chapter, at least one sign (using either letters or symbols) notifying when smoking is prohibited and one sign (using either letters or symbols) notifying when safety belts should be fastened must, when illuminated, be legible to each person seated in the passenger cabin under all probable conditions of cabin illumination. Signs which notify when safety belts should be fastened and when smoking is prohibited must be so constructed that the crew can turn them on and off.

b. Guidance.

(1) Each cabin occupant, including cabin attendants but not pilot compartment occupants, should be able to see a passenger information sign when seated in a seat occupiable for taxi, takeoff, and landing. This should be accomplished for any seat position such as upright, reclined, swiveled, or tracked. The sign should be readable by a person with 20/20 vision. To read the sign, the head may be moved about to normal positions, but not rotated backwards (tilted). This evaluation should be conducted with 5% female to 95% male occupants.

(2) The words "FASTEN SEAT BELT" and "NO SMOKING" are acceptable. In remote areas, such as the lavatory or lower lobe galley, a sign with the words "RETURN TO SEAT" is acceptable. This sign should be operated by the same switch as the "FASTEN SEAT BELT" sign switch.

(3) In compartments where smoking is not allowed, it may be necessary to “hard-wire” ON any lighted NO SMOKING signs to avoid confusing occupants. See related guidance for § 25.853.

(4) See Appendix 2 for acceptable symbols for these signs.

143 -160. [RESERVED]

SECTION 25.793 FLOOR SURFACES

161. Section 25.793 Did Not Exist Prior to Amendment 25-51.

162. AMENDMENT 25-51, Effective March 6, 1980.

a. Regulation.

> The floor surface of all areas which are likely to become wet in service must have slip resistant properties.

b. Guidance. Military Specification Mil-W-5044B, entitled "Walkway Compound, Nonslip and Walkway Matting, Nonslip", provides an acceptable standard for the slip resistant properties required by this paragraph as well as that of § 25.803.

163 - 250. [RESERVED]

SECTION 25.801 DITCHING

251. REGULATION IN EFFECT AT ADOPTION OF PART 25.

a. Regulation.

(a) If certification with ditching provisions is requested, the airplane must meet the requirements of this section and §§ 25.807(d), 25.1411, and 25.1415(a).

(b) Each practicable design measure, compatible with the general characteristics of the airplane, must be taken to minimize the probability that in an emergency landing on water, the behavior of the airplane would cause immediate injury to the occupants or would make it impossible for them to escape.

(c) The probable behavior of the airplane in a water landing must be investigated by model tests or by comparison with airplanes of similar configuration for which the ditching characteristics are known. Scoops, flaps, projections, and any other factor likely to affect the hydrodynamic characteristics of the airplane, must be considered.

(d) It must be shown that, under reasonably probable water conditions, the flotation time and trim of the airplane will allow the occupants to leave the airplane and enter the liferafts required by § 25.1415. If compliance with this provision is shown by buoyancy and trim computations, appropriate allowances must be made for probable structural damage and leakage. If the airplane has fuel tanks (with fuel jettisoning provisions) that can reasonably be expected to withstand a ditching without leakage, the jettisonable volume of fuel may be considered as buoyancy volume.

(e) Unless the effects of the collapse of external doors and windows are accounted for in the investigation of the probable behavior of the airplane in a water landing (as prescribed in paragraphs (c) and (d) of this section), the external doors and windows must be designed to withstand the probable maximum local pressures.

b. Guidance.

(l) Background Information. The expression "reasonably probable water conditions" is considered judgmental in application to compliance for ditching and has never been specifically defined as to sea state force or wave height. Early ditching investigations of dynamic models were conducted by the National Advisory Committee for Aeronautics (NACA) at Langley Field, Virginia, and NACA Report 1347, issued in 1958 and reflecting a compilation of such test results, set the precedence for early and modern transport airplane designers in substantiating

airplanes for ditching by analyses. Such early tests were based on calm-water landings with the supposition that rough-water landings of particular models that were made parallel to waves or swells would exhibit the
same general type of performance. Later rough-water ditching investigations of models were conducted and their results were compiled in documents such as Technical Note No. D-101, issued by the National Aeronautics and Space Administration (NASA) in 1959, and also referred to by designers in respective ditching analyses. In addition to reference to actual ditching incidents, it became an acceptable practice for designers to substantiate the ditching behavior of a proposed airplane design by comparisons in basic geometric configuration to airplane designs approved for ditching by the models tested at Langley Field. Parametric comparisons usually revealed some identicalness in geometric aspects and where obvious discrepancies in dimensional relationships were evident, predetermined correction factors were applied.

(2) Paragraph (b). Ditching load factors may be determined by model tests. Landing procedures or design measures must be established that limit the factors to those listed in § 25.561. Load factors above these are considered to expose occupants to injurious loads. In addition, standard parts such as seats, belts, and harnesses are designed to § 25.561 load factors. Higher load factors in the downward direction may be acceptable provided the structural components are designed for the higher loads and also provided it can be shown that the occupants are protected from serious injury under these loads.

(3) Paragraph (d). A maximum permissible evacuation time for liferafts per the rule is also considered judgmental in scope for ditching compliance. During certification, it is usually shown by analysis that an airplane will float for a period of time exceeding the most conservative estimate of time required to completely evacuate the airplane. Evacuation times and rates for liferaft type devices are normally established by analysis and included in the particular airplane model ditching and flotation document presented for approval during type certification.

(4) Paragraph (d). Prior to approval of any size or type of transport airplane for ditching approval under § 25.801, there must be evidence of an engineering evaluation of the provisions for installing the emergency equipment specified in § 25.1411.

(5) Paragraph (d). In approving an airplane for overwater flight certification, two ditching conditions are examined. The first condition is the "planned ditching" case in which there is sufficient time to prepare the airplane for ditching and adjustments have been made to airplane weight and c.g. to account for loss of such items as engines, nacelles, and trailing edge flaps on impact with the water. The other condition is the "unplanned ditching" (§ 25.807(d)) case in which the airplane enters the water with insufficient time to prepare for ditching. The most critical situation for this case is at maximum gross weight due to a failed or aborted takeoff. No airplane damage is considered for the "unplanned ditching" case.

(6) Paragraph (d). As to ditching structural criteria, external pressures must be determined for the fuselage and all external doors and exits that are subject to hydrodynamic forces. This can be determined by measurements on ditching models or by analysis based on tests. Section 25.533 "Hull and Main Float Bottom Pressure Loads" may be a source of some pressure information if similarity can be shown. The use of pressure distribution data from similar model airplanes is acceptable and is preferred over purely analytical methods.

252 - 270. [RESERVED]

SECTION 25.803 EMERGENCY EVACUATION

271. REGULATION IN EFFECT AT ADOPTION OF PART 25.

a. Regulation.

(a) Each crew and passenger area must have emergency means to allow rapid evacuation in crash landings, with the landing gear extended and retracted, considering the possibility of the airplane being on fire.

(b) The passenger and crew access doors and service doors may be considered as emergency exits if they meet the applicable requirements of this section and §§ 25.805 and 25.813.

(c) If the airplane is divided into separate compartments without the minimum unobstructed passageway between compartments required by § 25.813, this section and §§ 25.805 through 25.815 apply to each compartment independently.

b. Guidance.

(1) Paragraph (a). When installed above passenger egress paths, any features that hang (signs, video monitors etc.) from the ceiling should be at least 73" above the floor, unless they are retractable and are placarded to be retracted for TTL. These features should also be appropriately padded or rounded to preclude injury when persons are moving about the cabin in flight.

272. AMENDMENT 25-1, Effective June 7, 1965.

a. Change to Regulation.

Paragraph (c) was deleted from this regulation.

b. Guidance. There is no additional guidance for this amendment.

273. AMENDMENT 25-15, Effective October 24, 1967.

a. Change to Regulation.

(a) Each crew and passenger area must have emergency means to allow rapid evacuation in crash landings, with the landing gear extended and retracted, considering the possibility of the airplane being on fire.

(b) Passenger ventral and tail cone, crew access, and service doors may be considered as emergency exits if they meet the applicable requirements of this section and §§ 25.805 through 25.813.

(c) Except as provided in paragraph (d) of this section, on airplanes having a seating capacity of more than 44 passengers, it must be shown by actual demonstration that the maximum seating capacity, including the number of crewmembers required by the operating rules for which certification is requested can be evacuated from the airplane within 90 seconds. Evacuees using stands or ramps allowed by subparagraph (8) of this paragraph are considered to be on the ground when they are on the stand or ramp, provided that the acceptance rate of the stand or ramp is no greater than the acceptance rate of the means available on the airplane for descent from the wing during an actual crash situation. The demonstration must be conducted under the following conditions:

(1) It must be conducted either during the dark of the night or during daylight with the dark of the night simulated, utilizing only the emergency lighting system and utilizing only the emergency exits and emergency evacuation equipment on one side of the fuselage, with the airplane in the normal ground attitude, with landing gear extended.

(2) All emergency equipment must be installed in accordance with specified limitations of the equipment.

(3) Each external door and exit, and each internal door and curtain must be in a configuration to simulate a normal takeoff.

(4) Seat belts and shoulder harnesses (as required) must be fastened.

(5) A representative passenger load of persons in normal health must be used as follows:

(i) At least 30 percent must be female.

(ii) Approximately five percent must be over 60 years of age, with a proportionate number of females.

(iii) At least five percent but no more than 10 percent must be children under 12 years of age, prorated through that age group.

(6) Persons who have knowledge of the operation of the exits and emergency equipment may be used to represent an air carrier crew. Such representative crewmembers must be in their seats assigned for takeoff and landing and none may be seated next to an emergency exit unless that seat is his assigned seat for takeoff. They must remain in their assigned seats until receiving the signal for the beginning of the demonstration.

(7) There can be no practice or rehearsal of the demonstration for the passengers except that they may be briefed as to the location of all emergency exits before the demonstration.

(8) Stands or ramps may be used for descent from the wing to the ground.

(9) All evacuees other than those using an overwing exit must leave the airplane by the means provided as part of the airplane's equipment.

(d) The emergency evacuation demonstration need not be repeated after a change in the interior arrangement of the airplane or an increase of not more than five percent in passenger seating capacity over that previously approved by actual demonstration, or both, if it can be substantiated by analysis, taking due account of the differences, that all the passengers for which the airplane is certificated can evacuate within 90 seconds.

(e) An escape route must be established from each overwing emergency exit, marked and (except for flap surfaces suitable as slides) covered with a slip resistant surface.)

b. Guidance.

(1) Paragraph (c).

(i) "The maximum capacity for which certification is requested" refers to the airplane model presented for certification. Subsequent models which have planned passenger capacities in excess of the certificated model should be substantiated on an individual basis.

(ii) All passengers and crewmembers used in the demonstration must be evacuated to the ground or off-wing stand or ramp, if used, within 90 seconds to constitute a successful 90 seconds test. Use only the number of passengers for which approved seating is provided, not to exceed the limits of § 25.807(c) or (d). No credit is given for the number of evacuees on the ground at 90 seconds if all persons have not been evacuated.

(iii) FAA observers should be stationed inside the airplane at expected critical locations, and outside the airplane at each exit to be used.

(iv) The "acceptance rate" of the stand or ramp refers to the width of the passage to the stand or ramp.

(v) The airplane should be configured with minimum aisle and passage clearance expected to be type certificated. This may require combining features of more than one model.

(2) Paragraph (c)(1). One exit from each pair of exits should be used. Illumination on the floor or ground may be used, but it should be kept low and shielded against shining into the airplane windows or doors.

(3) Paragraph (c)(2).

(i) The emergency descent devices used in the demonstration should be those to be in the airplane type design. The slide certification program should have progressed to the point where the system is reliable and can be expected to perform safely during the demonstration.

(ii) The airplane interior need not be a specific airline configuration. For example, galleys and other furnishings may be simulated by mockups, seats need not be TSO'd, etc. The interior should be described in sufficient detail to allow an FAA conformity inspection and an FAA interior compliance inspection.

(4) Paragraph (c)(5). The following two age-sex distributions (A and B) are acceptable alternates to that stipulated in this paragraph:

A.

Age and Gender	Percent of Total Passengers
Male 21-50	Not to exceed 56%
Male 51-59	At least 9%
Male 60+	At least 3.5%
Female any age*	At least 24%
Female 51-59	At least 6%
Female 60+	At least 1.5%

* This is in addition to the 6% and 1.5% requirements for females 51-59 and 60+ respectively.

B.

Age and Gender	Percent of Total Passengers
Male 18-50	Not to exceed 52.5%
Male 51+	At least 15%
Female 18-50	At least 22.5%
Female 51+	At least 10%

Note: These tables have been revised in format to make them easier to understand, but are the same as in the previous version of this advisory circular.

(5) Paragraph (c)(6).

(i) Neither the crew nor passengers should hear or otherwise receive any indication that the demonstration is about to begin. The first indication to persons on board the airplane should be the test start signal.

(ii) Following the test start signal, the flightcrew should simulate the time required for normal pilot compartment procedures prior to evacuating the flight deck.

(iii) A group of crewmembers in excess of the number required for the demonstration should be available. The FAA will select the crew that will participate in the test from this group. Subsequent tests, if required, may use crewmembers from the group remaining.

(6) Paragraph (c)(8). If the airplane is equipped with an off-wing assist means, it should be used during the demonstration in lieu of any stands or ramps.

(7) Paragraph (c)(9).

(i) If safety pillows or other equipment unique to the active exits are employed, passengers and crew should enter the airplane through a tunnel or other means that prevents them from viewing the airplane exterior.

(ii) Video cameras used to record activity inside the airplane should be positioned so as not to reveal the exits used in this demonstration. This may require the installation of cameras at inoperative exits.

(iii) If exit deactivation is by an external indication (e.g., red light outside exit), this indication should not be visible from inside the airplane until after the demonstration has begun. Alternatively, unlit bulbs may be visible at all exits.

(iv) Airplanes equipped with emergency descent means should be so equipped at inactive exits as well as active exits.

(v) Safety personnel stationed outside the airplane to prevent injury to the participants, should not aid participants (until they have cleared the descent means) or interfere with the evacuation process, or position the assist means following its deployment.

(8) Paragraph (e).

(i) Military Specification Mil W-5044B, entitled "Walkway Compound, Nonslip and Walkway Matting, Nonslip", provides an acceptable standard for the slip resistant surface required by this paragraph as well as that of § 25.793.

(ii) A 42-inch wide escape path is acceptable for airplanes incorporating dual overwing Type III exits.

274. AMENDMENT 25-17, Effective June 20, 1968.

a. Change to Regulation.

> (c) Except as provided in paragraph (d) of this section, on airplanes having a seating capacity of more than 44 passengers, it must be shown by actual demonstration that the maximum seating capacity, including the number of crewmembers required by the operating rules, for which certification is requested can be evacuated from the airplane to the ground within 90 seconds. Evacuees using stands or ramps allowed by subparagraph (8) of this paragraph are considered to be on the ground when they are on the stand or ramp, provided that the passage width of the stand or ramp is no greater than the acceptance rate of the means available on the airplane for descent from the wing during an actual crash situation. The demonstration must be conducted under the following conditions:

b. Guidance. There is no additional guidance for this amendment.

275. AMENDMENT 25-20, Effective April 23, 1969.

a. Change to Regulation.

(b) Passenger ventral and tail cone exits and any floor level door or exit in the side of the fuselage (other than those leading into a cargo or baggage compartment that is not accessible from the passenger cabin) that is 44 or more inches high and 20 or more inches wide, but not wider than 46 inches, must meet the applicable emergency exit requirements of this section and §§ 25.807 through 25.813.

(c)(1) It must be conducted either during the dark of the night or during daylight with the dark of the night simulated, utilizing only the emergency lighting system and utilizing only the minimum number of required emergency exits and the emergency evacuation equipment on one side of the fuselage with the airplane in the normal ground attitude with landing gear extended.

b. Guidance. There is no additional guidance for this amendment.

276. AMENDMENT 25-32, Effective May 1, 1972.

a. Change to Regulation.

(e) An escape route must be established from each overwing emergency exit, and (except for flap surfaces suitable as slides) covered with a slip resistant surface. Except where a means for channeling the flow of evacuees is provided--

(1) The escape route must be at least 42 inches wide at Type A passenger emergency exits and must be at least two feet wide at all other passenger emergency exits, and

(2) The escape route surface must have a reflectance of at least 80 percent, and must be defined by markings with a surface-to- marking contrast ratio of at least 5:1.

b. Guidance. There is no additional guidance for this amendment.

277. AMENDMENT 25-46, Effective December 1, 1978.

a. Change to Regulation.

This amendment substantially revised the regulation to incorporate part 121 requirements.

(c) Except as provided in paragraph (d) of this section, for airplanes having a seating capacity of more than 44 passengers, it must be shown by actual

demonstration that the maximum seating capacity, including the number of crewmembers required by the operating rules for which certification is requested, can be evacuated from the airplane to the ground within 90 seconds. The demonstration must be conducted under the following conditions:

(1) It must be conducted either during the dark of the night or during daylight with the dark of the night simulated. If the demonstration is conducted indoors during daylight hours, it must be conducted with each window covered and each door closed to minimize the daylight effect. Illumination on the floor or ground may be used, but it must be kept low and shielded against shining into the airplane's windows or doors.

(2) The airplane must be in a normal attitude with landing gear extended.

(3) Stands or ramps may be used for descent from the wing to the ground, and safety equipment such as mats or inverted life rafts may be placed on the floor or ground to protect participants. No other equipment that is not part of the airplane's emergency evacuation equipment may be used to aid the participants in reaching the ground.

(4) Except as provided in paragraph (c)(1) of this section, only the airplane's emergency lighting system may provide illumination.

(5) All emergency equipment required for the planned operation of the airplane must be installed.

(6) Each external door and exit, and each internal door or curtain, must be in the takeoff configuration.

(7) Each crewmember must be seated in the normally assigned seat for takeoff and must remain in that seat until receiving the signal for commencement of the demonstration. Each crewmember must be--

(i) For compliance with this section or § 121.291 of this chapter, a member of a regularly scheduled line crew, or

(ii) For compliance with this section, a person having knowledge of the operation of exits and emergency equipment.

(8) A representative passenger load of persons in normal health must be used as follows:

(i) At least 30 percent must be females.

(ii) At least five percent must be over 60 years of age with a proportionate number of females.

(iii) At least five percent but not more than 10 percent, must be children under 12 years of age, prorated through that age group.

(iv) Three life-size dolls, not included as part of the total passenger load, must be carried by passengers to simulate live infants two years old or younger.

(v) Crewmembers, mechanics, and training personnel who maintain or operate the airplane in the normal course of their duties, may not be used as passengers.

(9) No passenger may be assigned a specific seat except as the Administrator may require. Except as required by paragraph (c)(12) section, no employee of the applicant may be seated next to an emergency exit.

(10) Seat belts and shoulder harness (as required) must be fastened.

(11) Before the start of the demonstration, approximately one-half of the total average amount of carry-on baggage, blankets, pillows, and other similar articles must be distributed at several locations in the aisles and emergency exits access ways to create minor obstructions.

(12) Each crewmember must be seated in his normally assigned seat for takeoff and must remain in that seat until receiving the signal for commencement of the demonstration.

(13) No prior indication may be given to any crewmember or passenger of the particular exits to be used in the demonstration.

(14) The applicant may not practice, rehearse, or describe the demonstration for the participants nor may any participant have taken part in this type of demonstration within the preceding six months.

(15) The pretakeoff passenger briefing required by § 121.571 of this chapter may be given. The passengers may also be advised to follow directions of crewmembers, but not be instructed on the procedures to be followed in the demonstration.

(16) If safety equipment as allowed by paragraph (c)(3) of this section is provided, either all passenger and cockpit windows must be blacked out or all of the emergency exits must have safety equipment in order to prevent disclosure of the available emergency exits.

(17) Not more than 50 percent of the emergency exits in the sides of the fuselage of an airplane that meet all of the requirements applicable to the required emergency exits for that airplane may be used for the demonstration. Exits that are not to be used in the demonstration must have the exit handle deactivated or must be indicated by red lights, red tape, or other acceptable means, placed outside the exits to indicate fire or other reason why they are unusable. The exits

to be used must be representative of all of the emergency exits on the airplane and must be designated by the applicant, subject to approval by the Administrator. At least one floor level exit must be used.

(18) All evacuees, except those using an over-the-wing exit, must leave the airplane by a means provided as part of the airplane's equipment.

(19) The applicant's approved procedures must be fully utilized during the demonstration.

(20) The evacuation time period is completed when the last occupant has evacuated the airplane and is on the ground. Provided that the acceptance rate of the stand or ramp is no greater than the acceptance rate of the means available on the airplane for descent from the wing during an actual crash situation, evacuees using stands or ramps allowed by paragraph (c)(3) of this section are considered to be on the ground when they are on the stand or ramp.

(d) A combination of analysis and test may be used to show that the airplane is capable of being evacuated within 90 seconds under the conditions specified in § 25.803(c) of this chapter if the Administrator finds that the combination of analysis and tests will provide data with respect to the emergency evacuation capability of the airplane equivalent to that which would be obtained by actual demonstration.

b. Guidance.

(1) Paragraph (c)(17). One exit from each pair of exits may be used to satisfy the 50 percent requirement.

(2) Paragraph (d). Evacuation analyses should be based on actual demonstrations used to show compliance with §§ 25.803 or 121.291 and/or other appropriate tests. If the test data is available, and applicable to the additional configuration, analysis may be conducted. The analysis should include consideration of exit size and distribution; slide deployment times and evacuee evacuation rates; analysis of critical passenger flow points i.e. door, aisle, slide, for evacuation rate limiting factor; expected evacuee behavior (hesitation, etc.) as observed on previous tests; and any other consideration pertinent to the particular model airplane.

(3) See AC 25.803-1A, Emergency Evacuation Demonstrations.

278 - 300. [RESERVED]

SECTION 25.805 FLIGHTCREW EMERGENCY EXITS

301. REGULATION IN EFFECT AT ADOPTION OF PART 25.

a. Regulation.

Except for airplanes with a passenger capacity of 20 or less in which the proximity of passenger emergency exits to the flightcrew area offers a convenient and readily accessible means of evacuation for the flightcrew, the following apply:

(a) There must be either one exit on each side of the airplane or a top hatch, in the flightcrew area.

(b) Each exit must be of sufficient size and must be located so as to allow rapid evacuation of the crew. An exit size and shape of other than at least 19 by 20 inches unobstructed rectangular opening may be used only if exit utility is satisfactorily shown, by a typical flight crewmember, to the Administrator.

b. Guidance.

(1) Also see § 25.809, as adopted, and associated guidance, especially relative to the requirement for crew exits to be openable from the outside.

(2) Paragraph (b). The demonstration required for acceptance of other than at least a 19- by 20-inch opening should be accomplished by at least a 95 percentile male (approximately74 inches tall, and weighing 210 pounds) with at least analytical consideration to the effects of the failure of one or more landing gear.

302 - 320. [RESERVED]

SECTION 25.807 PASSENGER EMERGENCY EXITS

321. REGULATION IN EFFECT AT ADOPTION OF PART 25.

a. Regulation.

(a) Type and location. For the purpose of this part, the types and locations of exits are as follows:

(l) Type I. This type must have a rectangular opening of not less than 24 inches wide by 48 inches high, with corner radii not greater than l/3 the width of the exit. The first Type I exit on each side of the fuselage must be in the rearward part of the passenger compartment unless another location affords a more effective means of passenger evacuation. Type I exits must be floor level exits.

(2) Type II. This type must have a rectangular opening of not less than 20 inches wide by 44 inches high, with corner radii not greater than l/3 the width of the exit. Unless Type I exits are required, one Type II exit on each side of the fuselage must be in the rearward part of the passenger compartment unless another location affords a more effective means of passenger evacuation. Type II exits must be floor level exits unless located over the wing, in which case they may not have a step-up inside the airplane of more than 10 inches nor a step-down outside the airplane of more than 17 inches.

(3) Type III. This type must have a rectangular opening of not less than 20 inches wide by 36 inches high, with corner radii not greater than l/3 the width of the exit, located over the wing, with a step-up inside the airplane of not more than 20 inches and a step-down outside the airplane of not more than 27 inches.

(4) Type IV. This type must have a rectangular opening of not less than 19 inches wide by 26 inches high, with corner radii not greater than l/3 the width of the exit, located over the wing, with a step-up inside the airplane of not more than 29 inches and a step-down outside the airplane of not more than 36 inches. Step-down distance, as used in this section, means the actual distance between the bottom of the required opening and a usable foothold, extending out from the fuselage, that is large enough to be effective without searching by sight or feel.

(b) Accessibility. Each required passenger emergency exit must be accessible to the passengers and located where it will afford the most effective means of passenger evacuation. Openings larger than those specified in this section, whether or not of rectangular shape, may be used if--

(l) The specified rectangular opening can be inscribed within the opening; and

(2) The base of the inscribed rectangular opening meets the specified step-down heights.

(c) Passenger emergency exits; side-of-fuselage. The exits prescribed in this paragraph need not be diametrically opposite each other, but must be provided as follows:

(l) Except as provided in subparagraphs (2) through (5) of this paragraph, the number and type of passenger emergency exits must be in accordance with the following table:

Passenger seating capacity	Emergency exits for each side of the fuselage			
	Type I	Type II	Type III	Type IV
1 through 10				1
1 through 19			1	
2 through 39		l		1
40 through 59	l			1
60 through 79	l		l	
80 through 109	l		l	l
110 through 139	2		l	
140 through 179	2		2	
180 through 219	2		2	

(2) Two Type IV exits may be installed instead of each required Type III exit.

(3) Additional exits, providing an effective means of passenger evacuation consistent with the minimum number prescribed in subparagraph (l) of this paragraph are required for airplanes with a passenger capacity of 220 or more.

(4) If there are additional emergency evacuation means on the airplane, the passenger/emergency exit relationship may be increased by not more than 10 passengers beyond the limits specified in subparagraph (l) of this paragraph. If this means is an approved inflatable slide installed at each floor level exit (other than over-the-wing exits), the passenger/emergency exit relationship may be increased by--

(i) Not more than five passengers on airplanes with at least two of these exits; and

(ii) Not more than 10 passengers on airplanes with at least four of these exits.

(5) For airplanes on which the vertical location of the wing does not allow the installation of over-the-wing exits, an exit of at least the dimensions of a Type III must be installed instead of each Type III and each Type IV exit required by subparagraph (l) of this paragraph.

(d) Ditching emergency exits. In addition to the requirements of paragraph (c) of this section, the following apply:

(l) There must be at least one emergency exit for each unit (or part of a unit) of 35 passengers, but no less than two such exits, both above the waterline with one on each side of the airplane, meeting the minimum dimensions of--

(i) A Type IV exit for airplanes with a passenger seating capacity of 10 or less; and

(ii) A Type III exit for airplanes with a passenger seating capacity of 11 or more.

(2) If side exits cannot be above the waterline, the side exits must be replaced by an equal number of overhead hatches of not less than the dimensions of a Type III exit except that, for airplanes with a passenger capacity of 35 or less, the two required Type III side exits need be replaced by only one overhead hatch.

(3) Two Type IV exits may be installed instead of each required Type III exit.

b. Guidance.

(1) The equivalency to that required by the regulations of nonstandard exits or arrangements may be determined by use of the Latin-Square test procedure. See Appendix 4 which was derived from Notice FS 8110.12, May 21, 1964, "Test Procedure for Evaluating Non-Standard Exits for Transport Category Airplanes."

(2) An “exit pair” consists of two exits of the same type, one in each side of the fuselage. The exits need not be the same size, nor do they have to be directly opposite each other. As long as the exits on both sides of the fuselage are uniformly distributed with respect to the passenger seating arrangement, a pair need not be the two exits that are physically closest to each other.

(3) Paragraph (c). An airplane with a Type I sized exit located in the forward left-hand side of the fuselage, a pair of Type III exits in the middle, and a Type I sized exit located in the aft right-hand side of the fuselage should be limited to a maximum passenger seating capacity of 70, because of concerns with oversized dead-end zones if either the left- or right-side exits are unusable.

(4) Paragraph (c). An airplane with a pair of exits forward in the fuselage with the left one Type I sized and the right one Type III sized, and a pair of exits in the aft end of the fuselage with the left one Type III sized and the right one Type I sized may be approved for passenger seating capacities up to 79. If an emergency evacuation demonstration is required, then either the left-side or right-side exits should be selected so as not to unduly penalize this well-balanced arrangement or to make a radical departure from all previous demonstrations.

(5) Paragraphs (c) and (d). When establishing the maximum capacity to be listed on the type data sheet, consideration should be given to all relevant parameters. For example, if the

exit-limited passenger capacity as defined in § 25.807(c) has not been substantiated by compliance with the evacuation demonstration requirements of § 25.803, the data sheet should reflect the evacuation limit and not the exit limit. Other limiting factors may be structural capability, seating density (uniform distribution of exits), or ditching exits. In any case, the data sheet should not list a capacity for which the airplane is not capable. When the type data sheet limit is not the § 25.807(c) exit limit, an additional note which briefly describes the reason for the limit is appropriate.
Note that, the eligibility complement is governed by the ditching requirements of § 25.807(d), whether certification for ditching is requested or not.

(6) Paragraph (c) and (d). Flight attendants are considered part of the crew and are not included in the passenger seating capacity mentioned in § 25.807(c) and (d).

322. AMENDMENT 25-15, Effective October 24, 1967.

a. Change to Regulation.

(a) Type and location. For the purpose of this part, the types and locations of exits are as follows:

(l) Type I. This type must have a rectangular opening of not less than 24 inches wide by 48 inches high, with corner radii not greater than one-third the width of the exit. Type I exits must be floor level exits.

(2) Type II. This type must have a rectangular opening of not less than 20 inches wide by 44 inches high, with corner radii not greater than one-third the width of the exit. Type II exits must be floor level exits unless located over the wing, in which case they may not have a step-up inside the airplane of more than 10 inches nor a step-down outside the airplane of more than 17 inches.

(3) Type III. This type must have a rectangular opening of not less than 20 inches wide by 36 inches high, with corner radii not greater than one-third the width of the exit, located over the wing, with a step-up inside the airplane of not more than 20 inches and a step-down outside the airplane of not more than 27 inches.

(4) Type IV. This type must have a rectangular opening of not less than 19 inches wide by 26 inches high, with corner radii not greater than one-third the width of the exit, located over the wing, with a step-up inside the airplane of not more than 29 inches and a step-down outside the airplane of not more than 36 inches.

(5) Ventral. This type is an exit from the passenger compartment through the pressure shell and the bottom fuselage skin. The dimensions and physical configuration of this type of exit must allow at least the same rate of egress as a Type I with the airplane in the normal ground attitude, with landing gear extended.

(6) Tail cone. This type is an aft exit from the passenger compartment through the pressure shell and through an openable cone of the fuselage aft of the pressure shell. The means of opening the tail cone must be simple and obvious, and must employ a single operation.

(7) Type A. An emergency exit may be designated as a Type A exit if the following criteria are met:

(i) There must be a rectangular opening not less than 42 inches wide by 72 inches high, with corner radii not greater than one-sixth of the width of the exit.

(ii) It must be a floor level exit.

(iii) Unless there are two or more main (fore and aft) aisles, the exit must be located so that there is passenger flow along the main aisle to that exit from both the forward and aft direction.

(iv) There must be an unobstructed passageway at least 36 inches wide leading from each exit to the nearest main aisle.

(v) If two or more main aisles are provided, there must be unobstructed cross aisles at least 20 inches wide between main aisles. There must be a cross aisle leading directly to each passageway between the exit and the nearest main aisle.

(vi) There must be at least one seat adjacent to each such exit that could be occupied by a flight attendant.

(vii) Adequate assist space next to each Type A exit must be provided at each side of the passageway, to allow the crewmember(s) to assist in the evacuation of passengers without reducing the unobstructed width of the passageway below that required by subdivision (iv) of this subparagraph.

(viii) At each nonoverwing exit there must be installed a slide capable of carrying simultaneously two parallel lines of evacuees.

(ix) Each overwing exit having a step-down must have an assist means unless the exit without an assist means can be shown to have a rate of passenger egress at least equal to that of the same type of non-over-wing exit. If an assist means is required it must be automatically deployed, and automatically erected, concurrent with the opening of the exit and self-supporting within 10 seconds. Step-down distance as used in this section means the actual distance between the bottom of the required opening and a usable foothold, extending out from the fuselage, that is large enough to be effective without searching by sight or feel.

(c) Passenger emergency exits. The prescribed exits need not be diametrically opposite each other nor identical in size and location on both sides. They must

be distributed as uniformly as practicable taking into account passenger distribution. The first floor level exit on each side of the fuselage must be in the rearward part of the passenger compartment unless another location affords a more effective means of passenger evacuation. Where more than one floor level exit per side is prescribed, at least one floor level exit per side must be located near each end of the cabin, except that this provision does not apply to combination cargo/passenger configurations. Exits must be provided as follows:

(l) Except as provided in subparagraphs (2) through (8) of this paragraph, the number and type of passenger emergency exits must be in accordance with the following table:

Passenger seating capacity (cabin attendants not included)	Emergency exits for each side of the fuselage			
	Type I	Type II	Type III	Type IV
1 through 10				1
11 through 19			1	
20 through 39		l		1
40 through 59	l			1
60 through 79	l		l	
80 through 109	l		l	l
110 through 139	2		l	
140 through 179	2		2	

(2) Two Type IV exits may be installed instead of each Type III exit prescribed in subparagraph (l) of this paragraph.

(3) If slides meeting the requirements of § 25.809(f)(l) are installed at floor-level exits (other than overwing exits), the passenger/emergency exit relationship specified in subparagraph (l) of this paragraph may be increased by--

(i) Not more than five passengers on airplanes with at least two of these exits; and

(ii) Not more than 10 passengers on airplanes with at least four of these exits.

However, no increase in passenger seating capacity is obtained under this subparagraph if an increase in passenger seating capacity is obtained under subparagraph (4) of this paragraph.

(4) An increase in passenger seating capacity above the maximum permitted under subparagraph (l) of this paragraph but not to exceed a total of 299 may be

allowed in accordance with the following table for each additional pair of emergency exits in excess of the minimum number prescribed in subparagraph (l) of this paragraph for 179 passengers:

Additional emergency exits (each side of fuselage)	Increase in passenger seating capacity allowed
Type A	100
Type I	45
Type II	40
Type III	35

(5) For passenger capacities in excess of 299, each emergency exit in the side of the fuselage must be either a Type A or a Type I. A passenger seating capacity of 100 is allowed for each pair of Type A exits and a passenger seating capacity of 45 is allowed for each pair of Type I exits.

(6) If a passenger ventral or tail cone exit is installed and can be shown to allow a rate of egress at least equivalent to that of Type III exit with the airplane in the most adverse exit opening condition because of the collapse of one or more legs of the landing gear, an increase in passenger seating capacity beyond the limits specified in subparagraph (l), (4), or (5) of this paragraph may be allowed as follows:

(i) For a ventral exit, 12 additional passengers.

(ii) For a tail cone exit incorporating a floor level opening of not less than 20 inches wide by 60 inches high, with corner radii not greater than one-third the width of the exit, in the pressure shell and incorporating an approved assist means in accordance with § 25.809(f)(l), 25 additional passengers; or

(iii) For a tail cone exit incorporating an opening in the pressure shell which is at least equivalent to a Type III emergency exit with respect to dimensions, step-up and step-down distance, and with the top of the opening not less than 56 inches from the passenger compartment floor, 15 additional passengers.

(7) For airplanes on which the vertical location of the wing does not allow the installation of overwing exits, an exit of at least the dimensions of a Type III must be installed instead of each Type III and each Type IV exit required by subparagraph (l) of this paragraph.

(8) Each emergency exit in the passenger compartment in excess of the minimum number of required emergency exits must meet the applicable requirements of §§ 25.809 through 25.812, and must be readily accessible.

(d) Ditching emergency exits for passengers. If the emergency exits required by paragraph (c) of this section do not meet subparagraphs (l) and (2) of this paragraph, exits must be added to meet them:

(l) A Type IV exit on each side of the airplane, both above the waterline, with a passenger seating capacity of 10 or less.

(2) A Type III exit for airplanes with a passenger seating capacity of 11 or more, with at least one emergency exit above the waterline for each unit (or part of a unit) of 35 passengers, but no less than two such exits, with one on each side of the airplane. However, where it has been shown through analysis, ditching demonstrations, or any other tests found necessary by the Administrator, that the evacuation capability of the airplane during ditching is improved by the use of larger exits or by other means, the passenger/exit ratio may be increased.

(3) If side exits cannot be above the waterline, the side exits must be replaced by an equal number of readily accessible overhead hatches of not less than the dimensions of a Type III exit except that, for airplanes with a passenger capacity of 35 or less, the two required Type III side exits need be replaced by only one overhead hatch.

(4) Two Type IV exits may be installed instead of each required Type III exit.

b. Guidance.

(1) Paragraph (a)(7)(iv) and (v). These two paragraphs define the requirements for passageways to Type A exits and cross aisles in two aisle airplanes. These provide sufficient access for two lines of evacuees to egress simultaneously:

(i) In order to achieve the dual lane flow of evacuees, § 25.807(a)(7)(iv) requires an unobstructed 36-inch width passageway that leads to the exit from the outboard side of the adjacent main aisle. It should not, however, encroach upon the crewmember assist spaces that are required on both sides of the exit by § 25.807(a)(7)(vii). This is particularly important to remember for those situations where the passageway is canted to meet the projected cross aisles, which are discussed below.

(ii) Additionally, where more than one main aisle is provided, § 25.807(a)(7)(v) requires that there must be an unobstructed 20-inch wide cross aisle, leading directly to the exit passageways. This cross aisle is considered to extend from the inboard side of one main aisle to the inboard side of the other main aisle. The required cross aisle does not have to be straight nor does it have to be normal to the main aisles.

(iii) For the case where the exit is located at the end of the passenger cabin and there are only two approach paths to the exit (the main aisle from one direction and the cross aisle), the 36-inch wide passageway should extend from the exit to the point where the evacuee flows from the main aisle and cross aisle merge to ensure the dual lane flow can be maintained.

(iv) In the other case, where the exit is not located at the end of the cabin and there are three approach paths (the main aisle from two directions and the cross aisle) to the exit, the 20-inch width of the cross aisle should be within the 36-inch width of the passageway when the cross aisle is projected normal to the main aisle. Some portion of the 20-inch wide cross aisle should be within the width of the projected door opening.

(v) If the boundaries of any of the aforementioned passageways, aisles or cross aisles are formed by passenger seats, ensure that the minimum requirements are met with the seat in the most adverse condition that is not prohibited by design.

(vi) Door and cross aisle visibility is also of prime importance when evaluating the safety level of an exit configuration. This is especially true when the cross aisle is displaced forward or aft from the exit opening or when a pair of exits are not directly across the airplane from each other. The configuration should provide a view across the airplane such that the exit on the other side is readily identifiable. Identification of the opposite exit may be via the exit marking sign, the exit opening handle and related markings or when the field of vision provided allows visual perception of sufficient detail to recognize that there is an exit across the airplane. This identification should be evaluated when standing at the center of the opposite exit. In certain cases, additional exit locator signs may be necessary to direct evacuees to the opposite exit.

(2) Paragraph (a) Exits may be "derated" in accordance with the requirements of a smaller type; that is, exits may not only be oversized, the interior may be reconfigured to specifically derate an exit that has previously been qualified as a larger type. In order to preclude the appearance of the exit being unusable, the following additional considerations have been found acceptable:

(i) Type A to Type I: Only seats may encroach into the projected exit opening, no more than 12". A 24" passageway should be provided, and seats may not breakover into this passageway. The operating handle should be visible from the aisle.

(ii) Type A to Type III: A 24" passageway should be provided, and seats may not breakover into this passageway. The operating handle should be visible from the aisle.

(iii) Type I to Type III: A 13" passageway is required when the passageway is bordered by seats, or by a seat and a wall. A 20" passageway should be provided when the passageway is bordered by walls and should be within the projected opening of the exit. The required Type III opening should be unobstructed inboard for the width of one passenger seat place. The operating handle should be visible from the aisle.

(3) Paragraph (c). Although these rules do not prescribe longitudinal distance between exits, they do specify passenger seating configurations matched to exit pairs in which factors of uniform exit distribution, accessibility and location to enhance effective egress must be considered. The uniform exit distribution should consider the situation where the exits on one side of the fuselage are unusable due to fire or other factors.

(4) Paragraph (c)(8). Regarding removal of excess exits, regardless of airplane certification basis, the following criteria applies:

(i) All interior and exterior exit signs, markings, and lighting pertaining to the deactivated exits must be removed. There must be no recognizable evidence of the deactivated exits, visible to occupants of the cabin. However, the exterior door outline and handle need not be obscured.

(ii) The modification which deactivates and obscures the exits must be approved through issuance of an STC by the Manager, Aircraft Certification Office having jurisdiction over the modification, and the airplane cabin, as modified, must remain in compliance with the certification basis of the model.

(iii) Also see AC 20-60, Accessibility to Excess Emergency Exits.

323. AMENDMENT 25-32, Effective May 1, 1972.

a. Change to Regulation.

(a) Type and location. For the purpose of this part, the types and locations of exits are as follows:

(3) Type III. This type must have a rectangular opening of not less than 20 inches wide by 36 inches high, with corner radii not greater than one-third the width of the exit, and with a step-up inside the airplane of not more than 20 inches. If the exit is located over-the-wing the step-down outside the airplane may not exceed 27 inches.

(c) Passenger emergency exits. The prescribed exits need not be diametrically opposite each other nor identical in size and location on both sides. They must be distributed as uniformly as practicable taking into account passenger distribution. If only one floor-level exit per side is prescribed, and the airplane does not have a tail cone or ventral emergency exit, the floor-level exits must be in the rearward part of the passenger compartment, unless another location affords a more effective means of passenger evacuation. Where more than one floor-level exit per side is prescribed, at least one floor-level exit per side must be located near each end of the cabin, except that this provision does not apply to combination cargo/passenger configurations. Exits must be provided as follows:

(l) Except as provided in subparagraphs (2) through (6) of this paragraph, the number and type of passenger emergency exits must be in accordance with the following table:

Passenger seating configuration (crewmember seats not included)	Emergency exits for each side of the fuselage

	Type I	Type II	Type III	Type IV
1 through 9				1
10 through 19			1	
20 through 39		l	1	
40 through 79	l		1	
80 through 109	l		l	
80 through 109	l		2	l
110 through 139	2		l	
140 through 179	2		2	

(2) An increase in the passenger seating configuration above the maximum permitted under subparagraph (l) of this paragraph but not to exceed a total of 299 seats may be allowed in accordance with the following table for each additional pair of emergency exits in excess of the minimum number prescribed in subparagraph (l) of this paragraph for 179 passenger seats:

Additional emergency exits (each side of fuselage)	Increase in passenger seating capacity allowed
Type A	100
Type I	45
Type II	40
Type III	35

(3) For passenger seating configurations in excess of 299 seats, each emergency exit in the side of the fuselage must be either a Type A or Type I. A passenger seating configuration of 100 seats is allowed for each pair of Type A exits and a passenger seating configuration of 45 seats is allowed for each pair of Type I exits.

(4) If a passenger ventral or tail cone exit is installed and can be shown to allow a rate of egress at least equivalent to that of a Type III exit with the airplane in the most adverse exit opening condition because of the collapse of one or more legs of the landing gear, an increase in the passenger seating configuration beyond the limits specified in subparagraph (l), (2), or (3) of this paragraph may be allowed as follows:

(i) For a ventral exit, 12 additional passenger seats.

(ii) For a tail cone exit incorporating a floor level opening of not less than 20 inches wide by 60 inches high, with corner radii not greater than one-third the width of the exit, in the pressure shell and incorporating an approved assist means in accordance with § 25.809(f)(l), 25 additional passenger seats.

(iii) For a tail cone exit incorporating an opening in the pressure shell which is at least equivalent to a Type III emergency exit with respect to dimensions, step-up and step-down distance, and with the top of the opening not less than 56 inches from the passenger compartment door, 15 additional passenger seats.

(5) For airplanes on which the vertical location of the wing does not allow the installation of overwing exits, an exit of at least the dimensions of a Type III exit must be installed instead of each Type IV exit required by subparagraph (l) of this paragraph.

(6) Each emergency exit in the passenger compartment in excess of the minimum number of required emergency exits must meet the applicable requirements of §§ 25.809 through 25.812, and must be readily accessible.

(d) Ditching emergency exits for passengers. Ditching emergency exits must be provided in accordance with the following requirements, unless the emergency exits required by paragraph (c) of this section already meet them:

(l) For airplanes that have a passenger seating configuration, excluding pilots seats, of nine seats or less, one exit above the waterline in each side of the airplane, meeting at least the dimensions of a Type IV exit.

(2) For airplanes that have a passenger seating configuration excluding pilots seats, of 10 seats or more, one exit above the waterline in a side of the airplane, meeting at least the dimensions of a Type III exit, for each unit (or part of a unit) of 35 passenger seats, but no less than two such exits in the passenger cabin, with one on each side of the airplane. However, where it has been shown through analysis, ditching demonstrations, or any other tests found necessary by the Administrator, that the evacuation capability of the airplane during ditching is improved by the use of larger exits, or by other means, the passenger seat/exit ratio may be increased.

(3) If side exits cannot be above the waterline, the side exits must be replaced by an equal number of readily accessible overhead hatches of not less than the dimensions of a Type III exit except that, for airplanes with a passenger configuration, excluding pilots seats, of 35 seats or less, the two required Type III side exits need be replaced by only one overhead hatch.

b. Guidance.

(1) By this amendment, Type III exits were not restricted to overwing locations. Further, Type IV exits were restricted to airplanes that have a passenger seating capacity of nine or less, as reflected in the § 25.807(c)(l) table.

(2) Paragraph (2). The wording “a passenger seating configuration, excluding pilot seats, of 10 seats or more,” which was promulgated with the intent of being consistent with Amendment 23-10 to part 23, does not directly address seats intended for use by

observers or flight attendants. Seats approved for use by observers or flight attendants are not included in the passenger seating configuration.

(3) Paragraph (3). The wording "a passenger seating configuration, excluding pilot seats, of 35 seats or less," which was promulgated with the intent of being consistent with Amendment 23-10 to part 23, does not directly address seats intended for use by observers or flight attendants. Seats approved for use by observers or flight attendants are not included in the passenger seating configuration.

324. AMENDMENT 25-39, Effective February 10, 1977.

a. Change to Regulation.

(c) Passenger emergency exits.

(2) An increase in the passenger seating configuration above the maximum permitted under subparagraph (l) of this paragraph but not to exceed a total of 299 seats may be allowed in accordance with the following table for each additional pair of emergency exits in excess of the minimum number prescribed in subparagraph (l) of this paragraph for 179 passenger seats:

Additional emergency exits (each side of fuselage)	Increase in passenger seating capacity allowed
Type A	110
Type I	45
Type II	40
Type III	35

(3) For passenger seating configurations in excess of 299 seats, each emergency exit in the side of the fuselage must be either a Type A or Type I. A passenger seating configuration of 110 seats is allowed for each pair of Type A exits and a passenger seating configuration of 45 seats is allowed for each pair of Type I exits.

b. Guidance. There is no additional guidance for this amendment.

325. AMENDMENT 25-46, Effective February 11, 1978.

a. Change to Regulation.

(a) Type and location. For the purpose of this part, the types and locations of exits are as follows:

(7) Type A. An emergency exit may be designated as a Type A exit if the following criteria are met:

(vi) There must be at least one flight attendant seat, which meets the requirements of § 25.785(h) and (i), adjacent to each such exit.

b. Guidance.

(1) The intent of this amendment was to specify that the seat required by the present § 25.807(a)(7)(vi) must be a flight attendant seat.

(2) Paragraph (a)(7)(vi). The intent of the use of the word “adjacent” is to require the flight attendant seat to be closer to the exit than if the word “near” were used. Typically, the flight attendant seat should be located on one of the boundaries of the passageway to the exit. Consideration for an alternative location may be given if the flight attendant seat is located such that the flight attendant will be able to reach the exit faster than any passenger seated in the vicinity of the exit.

326. AMENDMENT 25-55, Effective April 26, 1982.

a. Change to Regulation.

(d) Ditching emergency exits for passengers. Whether or not ditching certification is requested, ditching emergency exits must be provided in accordance with the following requirements, unless the emergency exits required by paragraph (c) of this section already meet them:

b. Guidance. The rule was amended to make it clear that all transport category airplanes must have ditching exits whether or not ditching certification was requested. Actually, this guidance has been in effect since April 9, 1957, as reflected in Amendment 4b-5, "Emergency Evacuation Provisions," to CAR 4b.

327. AMENDMENT 25-67, Effective July 24, 1989.

a. Change to Regulation.

(c)(7) For an airplane that is required to have more than one passenger emergency exit on each side of the fuselage, no passenger emergency exit shall be more than 60 feet from any adjacent passenger emergency exit on the same side of the same deck of the fuselage, as measured parallel to the airplane's longitudinal axis between the nearest exit edges.

b. Guidance. Also see § 25.2(b) at this amendment.

328 - 350. [RESERVED]

SECTION 25.809 EMERGENCY EXIT ARRANGEMENT

351. REGULATION IN EFFECT AT ADOPTION OF PART 25.

a. Regulation.

(a) Each emergency exit, including a flightcrew emergency exit, must be a movable door or hatch in the external walls of the fuselage, allowing unobstructed opening to the outside.

(b) Each emergency exit must be openable from the inside and the outside except that sliding window emergency exits in the flightcrew area need not be openable from the outside if other approved exits are convenient and readily accessible to the flightcrew area.

(c) The means of opening emergency exits must be simple and obvious and may not require exceptional effort. Internal exit-opening means involving sequence operations (such as operation of two handles or latches or the release of safety catches) may be used for flightcrew emergency exits if it can be reasonably established that these means are simple and obvious to crewmembers trained in their use.

(d) There must be a means to lock each emergency exit and to safeguard against its opening in flight, either inadvertently by persons or as a result of mechanical failure. In addition, there must be a means for direct visual inspection of the locking mechanism by crewmembers to determine that each emergency exit, for which the initial opening movement is outward, is fully locked.

(e) There must be provisions to minimize the probability of jamming of the emergency exits resulting from fuselage deformation in a minor crash landing.

(f) Each landplane emergency exit (other than exits located over the wing) more than six feet from the ground with the airplane on the ground and the landing gear extended, must have an approved means to assist the occupants in descending to the ground. In addition--

(1) The assist device for crew exits may be a rope or any other device demonstrated to be suitable for the purpose;

(2) The assist device for passenger exits may be an inflatable slide, a noninflatable slide, or other approved device; and

(3) Ropes and ladders may not be used at passenger floor level exits.

(g) The proper functioning of each emergency exit must be shown by tests.

b. Guidance.

(1) Paragraph (b). Other approved exits should be usable for rescue personnel to assist incapacitated flight crewmembers. If a cockpit flightcrew exit is not openable from the outside on the left side, another approved exit should be on the left side that is openable from the outside. The same applies to the right side. Also, see § 25.805.

Some airplanes initially certificated as passenger configurations may include cockpit windows that are openable only from the inside. On those airplanes, convenient and readily accessible passenger exits on both sides of the fuselage, that are openable from both the inside and outside, have been approved to comply with this requirement. When these airplanes are reconfigured as cargo-only airplanes, with an accompanying proposal to deactivate one of these passenger doors, provision must be made for continued compliance with this requirement (e.g., reconfiguring the cockpit window on that side so that is openable from the outside. In addition, consideration must be given for the continued capability to evacuate incapacitated occupants from that side of the airplane).

(2) Paragraph (b). The requirement that each emergency exit be openable from the inside and outside does not apply when the airplane is parked and unoccupied. It is acceptable to have locks that prevent unauthorized entry provided there are also satisfactory means to ensure that the locks are disengaged prior to passenger boarding. Such satisfactory means will vary depending on the size and complexity of the airplane. Cockpit annunciator lights are not necessary unless the emergency exits are so remotely located or numerous that lock disengagement might be overlooked. A lock pin with a red flag in an exit is satisfactory. The AFM should include a preflight checklist in the Procedures Section requiring the lock pin removal.

(3) Paragraph (c). The exits should be openable when the fuselage is pressurized to the maximum allowed for takeoff and landing. Usually this pressure is about 0.125 psi. If design features such as automatic bleed-off, would make this full pressure unlikely, the exits should be openable at whatever pressure can reasonably be expected after taxi, rejected takeoff (RTO), or minor crash landing.

(4) Paragraph (e). A hole in the fuselage, such as an exit, inevitably has stronger structure surrounding it and is an acceptable provision. Clearances to account for deflections such as the doors, structure, and hinges, are also provisions. A minor crash landing is one in which the ultimate inertia forces of § 25.561(b)(3) is experienced.

(5) Paragraph (f). Large transport airplanes typically have heights from cockpit windows and/or floor level exits to the ground that may preclude the use of ropes as an acceptable assist means for egress. Demonstrations have shown that typical occupants do not have the upper body strength and/or stamina to descend a rope over longer distances without unacceptable slipping and/or falling. Consequently, alternative means, such as inertia reels or slides should be utilized, as appropriate.

(6) Paragraph (f). Part 25 addresses requirements for crew and passenger occupants only. It did not envision nor does it specifically address an increasingly common category of occupant approved (by exemption) for freighter airplanes: supernumeraries (ref. § 121.583).

Supernumeraries are typically employed in some fashion to facilitate the movement or care of cargo, generally receive some degree of training over and above that possessed by passengers, and a relatively very few of them are accommodated onboard any particular airplane. Consequently, the terms of each exemption approving the carriage of supernumeraries are tailored to the particular installations and training involved. But in general, the FAA has conservatively considered supernumeraries to be more like passengers than crew, and encourages and expects supernumeraries to be afforded the same overall level of safety as for passengers, to the maximum extent practicable--except that, for supernumeraries, more consideration is permitted for training and other special circumstances to achieve the requisite level of safety. For example, escape slides have typically been retained on freighter conversions. But in some limited special instances, inertial reels have been approved in lieu of slides.

(7) Paragraph (f)(1). If a rope is provided for crew exits, it should be attached to the fuselage structure at or above the upper limit of the exit opening. The rope and attachment should be capable of withstanding a 400-pound static load. Useability of the rope should be demonstrated by a 5 percentile female (approximately 60 inches tall and 102 pounds) as well as a 95 percentile male (approximately 74 inches tall and 210 pounds).

352. AMENDMENT 25-1, Effective June 7, 1965.

a. Change to Regulation.

> (f) Each landplane emergency exit more than six feet from the ground with the airplane on the ground and the landing gear extended and each over-the-wing emergency exit must have an approved means to assist the occupants in descending to the ground. The assisting means for a floor level passenger emergency exit must be a slide, or an equivalent approved device. The assisting means for any other emergency exit must be a rope at least 5/8-inch in diameter, or an equivalent approved device. If the assisting means is a rope or an approved device equivalent to a rope, it must be--
>
> (1) Attached to the fuselage structure at or above the top of the emergency exit opening, or, for a device at a pilot's emergency exit window, at another approved location if the stowed device, or its attachment, would reduce the pilot's view in flight;
>
> (2) Able (with its attachment) to withstand a 400-pound static load; and
>
> (3) For an over-the-wing emergency exit, long enough to allow descent over the leading or trailing edge of the wing, whichever distance is longer.

b. Guidance. There is no additional guidance for this amendment.

353. AMENDMENT 25-9, Effective June 30, 1966.

a. Change to Regulation.

Paragraph (f)(3) was deleted from this regulation.

b. Guidance. There is no additional guidance for this amendment.

354. AMENDMENT 25-15, Effective October 24, 1967.

a. Change to Regulation.

> (f) Each landplane emergency exit (other than exits located over the wing) more than six feet from the ground with the airplane on the ground and the landing gear extended must have an approved means to assist the occupants in descending to the ground as follows:
>
> (1) The assisting means for each passenger emergency exit must be a self-supporting slide or equivalent, and must be designed so that it is--
>
> (i) Automatically deployed, and automatically erected, concurrent with the opening of the exit except that the assisting means may be erected in a different manner when installed at service doors that qualify as emergency exits, and at passenger doors; and
>
> (ii) Erectable within 10 seconds and of such length that the lower end is self-supporting on the ground after collapse of any one or more landing gear legs.
>
> (2) The assisting means for flightcrew emergency exits may be a rope or any other means demonstrated to be suitable for the purpose. If the assisting means is a rope, or an approved device equivalent to a rope, it must be--
>
> (i) Attached to the fuselage structure at or above the top of the emergency exit opening, or, for a device at a pilot's emergency exit window, at another approved location if the stowed device, or its attachment, would reduce the pilot's view in flight;
>
> (ii) Able (with its attachment) to withstand a 400-pound static load.
>
> (h) If the trailing edge of the flaps in the landing position is more than six feet above the ground with the airplane on the ground and the landing gear extended, or if the wing is more than six feet above the ground with the landing gear extended and the flaps are unsuitable as a slide, means must be provided to assist evacuees (who have used the overwing exits) to reach the ground.

b. Guidance.

(1) Paragraph (f)(1). To be self-supporting, the bottom end of the slide should rest on the ground. If it does not rest on the ground, the slide should look and be usable by passengers. When the passenger uses the slide, the bottom end should rest on the ground and allow the passenger to egress the slide readily.

(2) Paragraph (f)(1)(i). There should be a positive visual means of determining girt bar engagement to assure that the assisting means can be automatically deployed.

(3) Paragraph (f)(1)(i). Passenger doors are those that can be expected to be used for normal passenger loading. Current airport terminal passenger loading facilities should be considered. An emergency exit qualifies as a service door if such as a galley or service bar is adjacent to the exit. An exit is not a service door if the galley is on the other side of the airplane with its own door. When the interior is used in more than one configuration, where the exit is a service door at times and solely an emergency exit at other times, the rule allows fully automatic slides at all times, or conversion from automatically inflated to manually inflated as the exit status varies. Since the second option may be impractical, the use of fully automatic slides at all times would be acceptable. If it is felt that fully automatic slides may be hazardous to ground personnel, it would be acceptable to install a warning placard or red webbing stretched across the door window. A manual inflation handle with placarding is an acceptable different manner for slide erection.

(4) Paragraph (f)(1)(ii). Collapse of any one or more landing gear legs will cause the slide angle to vary from the normal angle. At these various angles, it will be acceptable if the assisting means is safely usable by normal, healthy passengers. If this is not obvious by inspection, it should be demonstrated by test. The evacuation rate need not be the same as that with a normal angle. The adverse attitude also should be evaluated for the cockpit emergency egress provisions.

(5) Paragraph (h). The six feet above the ground may be measured as follows:

(i) At the lowest point along the required escape route,

(ii) When the airplane is on level ground,

(iii) The gross weight and center of gravity (c.g.) location should be considered for a typical takeoff configuration for the critical flap setting,

(iv) The flap setting should be the highest landing setting allowed in the AFM,

(v) The landing gear oleo setting, tire pressure and any other rigging dependent tolerances should be the average, and

(vi) The landing gear strut and tire compression should be based on the gross weight and c.g. location used in paragraph (5)(iii) above.

355. AMENDMENT 25-32, Effective, May 1, 1972.

a. Change to Regulation.

(b) Each emergency exit must be openable from the inside and the outside except that sliding window emergency exits in the flightcrew area need not be openable from the outside if other approved exits are convenient and readily accessible to the flightcrew area. Each emergency exit must be capable of being opened, when there is no fuselage deformation--

(1) With the airplane in the normal ground attitude and in each of the attitudes corresponding to collapse of one or more legs of the landing gear; and

(2) Within ten seconds measured from the time when the opening means is actuated to the time when the exit is fully opened.

(f) Each landplane emergency exit (other than exits located over the wing) more than six feet from the ground with the airplane on the ground and the landing gear extended must have an approved means to assist the occupants in descending to the ground as follows:

(1) The assisting means for each passenger emergency exit must be a self-supporting slide or equivalent, and must be designed to meet the following requirements:

(i) It must be automatically deployed and deployment must begin during the interval between the time the exit opening means is actuated from inside the airplane and the time the exit is fully opened. However, each passenger emergency exit which is also a passenger entrance door or a service door must be provided with means to prevent deployment of the assisting means when it is opened from either the inside or the outside under nonemergency conditions for normal use.

(ii) It must be automatically erected within 10 seconds after deployment is begun.

(iii) It must be of such length that the lower end is self-supporting on the ground after collapse of one or more legs of the landing gear.

(g) Each emergency exit must be shown by tests, or by a combination of analysis and tests, to meet the requirements of paragraphs (b) and (c) of this section.

(h) If the place on the airplane structure at which the escape route required in § 25.803(e) terminates is more than six feet from the ground with the airplane on the ground and the landing gear extended, means must be provided to assist evacuees (who have used the overwing exits) to reach the ground. If the escape route is over a flap, the height of the terminal edge must be measured with the flap in the takeoff or landing position,

whichever is higher from the ground. The assisting means must be of such length that the lower end is self-supporting on the ground after collapse of any one or more landing gear legs.

(i) If a single power-boost or single power-operated system is the primary system for operating more than one exit in an emergency, each exit must be capable of meeting the requirements of paragraph (b) of this section in the event of failure of the primary system. Manual operation of the exit (after failure of the primary system) is acceptable.

b. Guidance.

(1) Paragraph (f)(1)(i). A passenger entrance door and service door are defined the same as that for passenger doors and service doors in paragraph 354b(3).

(2) Paragraph (h). The guidance stated in paragraph 354b(5) of this AC applies to this amendment except paragraph 354b(5)(iv), as applied here, should read: "The flap setting should be the highest takeoff or landing setting allowed in the AFM."

356. AMENDMENT 25-34, Effective December 31, 1972.

a. Change to Regulation.

(j) When required by the operating rules for any large passenger-carrying turbojet powered airplane, each ventral exit and tailcone exit must be--

(1) Designed and constructed so that it cannot be opened during flight; and

(2) Marked with a placard readable from a distance of 30 inches and installed at a conspicuous location near the means of opening the exit, stating that the exit has been designed and constructed so that it cannot be opened during flight.

b. Guidance. There is no additional guidance for this amendment.

357. AMENDMENT 25-46, Effective December 1, 1978.

a. Change to Regulation.

(f)(1)(iv) It must have the capability, in 25-knot winds directed from the most critical angle, to deploy and, with the assistance of only one person, to remain usable after full deployment to evacuate occupants safely to the ground.

(v) For each system installation (mockup or airplane installed), five consecutive deployment and inflation tests must be conducted (per exit) without failure, and at least three tests of each such five-test series must be conducted using a single representative sample of the device. The sample devices must be deployed and inflated by the system's primary means after being subjected to the inertia forces

specified in § 25.561(b). If any part of the system fails or does not function properly during the required tests, the cause of the failure or malfunction must be corrected by positive means and after that the full series of five consecutive deployment and inflation tests must be conducted without failure.

b. Guidance.

(1) Paragraph (f)(1)(iv).

(i) The person who assists should come from the airplane. This capability should be demonstrated by test.

(ii) Escape slides that deploy in front of an engine inlet may need to be assessed for the effect of the inlet airflow on the acceptable deployment of the escape slide. Since the wind condition is assumed, the effect of the inlet airflow should be considered in combination with the 25-kt. wind. The effect of the engine is non-linear with respect to distance from the inlet, so that tests that do not use an actual running engine should have suitable conservatism to ensure that the installation is acceptable. For example, adding the effect of the engine (at specific distance from the inlet) to the wind velocity, and then verifying that the slide will come no closer to the engine than that distance is an acceptable method.

(2) Paragraph (f)(1)(v). The five tests should be conducted for each individual exit. For instance, if there are a total of four Type I exits in the airplane and each exit with each slide installation identical, a total of 20 deployment and inflation tests should be conducted, five on each exit. A lesser number of tests may be acceptable for a modification to the system installation or slide design.

(3) Paragraph (f)(1)(v). The packed escape slide as installed in the airplane, up to and including the hardware that attaches the slide to the door, should be subjected to the specified inertia forces. Each escape slide used in the test program should be subjected to the inertia forces, but need not be subjected to the inertia forces more than once, even though it may be tested more than once.

(4) For wind or repeatability tests, as many deployments as possible should be done on an airplane. When using a mockup (also known as a module) for these tests, the following items, as a minimum, should be satisfactorily addressed:

(i) The door on the mockup should be a full-size door built as close to a production door as possible, using production hardware or prototype equivalents. This is especially critical with respect to the girt bar, floor fittings, packboard, bustle, the door motion, door velocity throughout the range of travel, and the manner in which the slide drops.

(ii) The fuselage contour and skin surface of the mockup which might be contacted by the slide, under any normal or adverse attitude or wind conditions, should be the same as the airplane contour. Additionally, fuselage protuberances such as pitot-static tubes and outflow valves should be accurately represented.

(iii) The impingement of the wind on the slide should be shown by aerodynamic analysis to be equal or greater than that on the airplane.

358. AMENDMENT 25-47, Effective December 24, 1979.

a. Change to Regulation.

(f)(1)(iii) It must be of such length after full deployment that the lower end is self-supporting on the ground and provides safe evacuation of occupants to the ground after collapse of one or more legs of the landing gear.

b. Guidance. Paragraph (f)(1)(iii). In order to meet the 25 knot wind requirement, the escape slide presses against the fuselage and the end of the unoccupied slide may not be in physical contact with the ground, especially in the most adverse attitude (gear collapse). This condition has been found to be acceptable provided the slide is self-supporting on the ground shortly after an evacuee has entered the slide and prior to the evacuee reaching the end of the slide. The unoccupied slide, when viewed from the exit, should not give the visual impression that the slide is unsafe for use.

359 - 380. [RESERVED]

SECTION 25.811 EMERGENCY EXIT MARKING

381. REGULATION IN EFFECT AT ADOPTION OF PART 25.

a. Regulation.

(a) Each passenger emergency exit, its means of access, and its means of opening must be conspicuously marked.

(b) The identity and location of each emergency exit must be recognizable from a distance equal to the width of the cabin.

(c) The location of each emergency exit operating handle and the instructions for opening must be marked on or adjacent to the emergency exit, and this marking must be readable from a distance of 30 inches.

(d) A source of light, independent of the main lighting system, must be installed to illuminate each passenger emergency exit marking.

(e) Each exit light must be designed to function automatically in a crash landing and to operate manually.

(f) Each emergency exit that is required to be openable from the outside, and its means of opening, must be marked on the outside of the airplane.

(g) Exits marked as emergency exits, though in excess of the required number of emergency exits, must meet the requirements for emergency exits of the particular type. Emergency exits customarily used in entering or leaving the airplane need only be marked with the word "EXIT".

b. Guidance. Paragraphs (a) and (c). Exit identity and conspicuity of operating instructions should be readable by a person with 20/20 vision making a normal effort under representative day and emergency night lighting.

382. AMENDMENT 25-1, Effective June 7, 1965.

a. Change to Regulation.

(a) Each passenger emergency exit, its means of access, and its means of opening must be conspicuously marked.

(b) The identity and location of each passenger emergency exit must be recognizable from a distance equal to the width of the cabin.

(c) The location of each passenger emergency exit must be indicated by a sign visible to occupants approaching along the main passenger aisle. There must be a locating sign --

(1) Above the aisle near each over-the-wing passenger emergency exit, or at another ceiling location if it is more practical because of low headroom;

(2) Next to each floor level passenger emergency exit, except that one sign may serve two such exits if they both can be seen readily from that sign; and

(3) On each bulkhead or divider that prevents fore and aft vision along the passenger cabin, to indicate emergency exits beyond and obscured by it, except that if this is not possible the sign may be placed at another appropriate location.

(d) Each passenger emergency exit marking and each locating sign must have white letters one inch high on a red background two inches high, be self or electrically illuminated, and have a minimum luminescence (brightness) of at least 160 microlamberts. The colors may be reversed if this will increase the emergency illumination of the passenger compartment.

(e) The location of each passenger emergency exit operating handle and instructions for opening must be shown:

(1) For each emergency exit, by a marking on or near the exit that is readable from a distance of 30 inches.

(2) In addition, for each Type I or Type II emergency exit with a locking mechanism released by rotary motion of the handle, by --

(i) A red arrow, with a shaft at least 3/4 inch wide and a head twice the width of the shaft, extending along at least 70 degrees of arc at a radius approximately equal to 3/4 of the handle length; and

(ii) The word "open" in red letters one inch high, placed horizontally near the head of the arrow.

(f) A source of light, independent of the main lighting system, must be installed to --

(1) Illuminate each passenger emergency exit marking and locating sign; and

(2) Provide enough general lighting in the passenger cabin so that the average illumination, when measured at 40-inch intervals at seat armrest height on the center line of the main passenger aisle, is at least 0.05 foot-candles.

(g) Each light required by paragraph (f) of this section must be designed to be operable manually, and to operate automatically, when armed if necessary, from the independent lighting system required by paragraph (f) of this section in a crash landing or whenever the airplane's normal electrical power to the light is interrupted.

(h) Each emergency exit that is required to be openable from the outside, and its means of opening, must be marked on the outside of the airplane. In addition, the following apply:

(1) There must be a two-inch colored band outlining the exit.

(2) Each outside marking, including the band, must differ in color from the surrounding fuselage surface so that the reflectance of the lighter color exceeds the reflectance of the darker color by a factor of at least three. "Reflectance" is the ratio of the luminous flux reflected by a body to the luminous flux it receives.

(i) Exits marked as emergency exits, though in excess of the required number of emergency exits, must meet the requirements for emergency exits of the particular type. Emergency exits customarily used in entering or leaving the airplane need only be marked with the word "Exit."

b. Guidance.

(1) Paragraph (c). The signs required by paragraphs (c)(1) and (3) should be removed from the passenger compartment in mixed passenger/cargo arrangements if they indicate exits in the cargo compartment which are not accessible to passengers. For exits inaccessible in the cargo portion of the fuselage, the signs installed by this paragraph for passenger configurations may be left installed if they are not visible to the passengers.

(2) Paragraph (c)(2). The requirement for a sign next to each floor level exit is not satisfied by a sign mounted on the exit. The sign should remain visible whether or not the exit is open. In the case of an exit-mounted sign, the sign is removed when the exit is opened. This arrangement should not be employed.

(3) Paragraph (e)(2). An exit opening handle where motion is in the plane perpendicular to the exit is not considered a rotary handle as defined in this paragraph. Therefore, the marking arrow specified is not required by this regulation. However, in order to provide an equivalent level of safety for this type of handle motion, markings appropriate to this type of handle should be provided. This should be documented in an Equivalent Safety Finding Issue Paper.

(4) Paragraphs (d) and (f)(2). Advisory Circular 20-38A, Measurement of Cabin Interior Emergency Illumination in Transport Airplanes, provides guidance material for the measurements required in these paragraphs. NOTE: These regulations were incorporated into § 25.812 by Amendment 25-15.

(5) Paragraph (f)(2). See § 25.812(c) in effect by Amendment 25-15 and associated guidance.

(6) Paragraph (h).

(i) Guidance material for exterior colored bands around exits is provided in AC 20-47, Exterior Colored Band Around Exits on Transport Airplanes.

(ii) For airplanes that are convertible from passenger to mixed passenger/cargo arrangements, the exits unusable due to cargo blockage should be so marked. This can be indicated by a placard on or adjacent to the exit. The placard should provide obvious indication from the ground, to a rescue crew that the exit is not operable. No other change to the external markings is required.

(iii) If exits are deactivated, refer to § 25.807, Amendment 25-15, for guidance regarding deletion of markings for deactivated exits.

(7) Paragraphs (h) and (i). "Exit" or "Emergency Exit" need not be included with required exterior markings.

383. AMENDMENT 25-15, Effective October 24, 1967.

a. Change to Regulation.

(a) Each passenger emergency exit, its means of access, and its means of opening must be conspicuously marked.

(b) The identity and location of each passenger emergency exit must be recognizable from a distance equal to the width of the cabin.

(c) Means must be provided to assist the occupants in locating the exits in conditions of dense smoke.

(d) The location of each passenger emergency exit must be indicated by a sign visible to occupants approaching along the main passenger aisle. There must be a locating sign --

(1) Above the aisle near each over-the-wing passenger emergency exit, or at another ceiling location if it is more practical because of low headroom;

(2) Next to each floor level passenger emergency exit, except that one sign may serve two such exits if they both can be seen readily from the sign; and

(3) On each bulkhead or divider that prevents fore and aft vision along the passenger cabin to indicate emergency exits beyond and obscured by it, except that if this is not possible the sign may be placed at another appropriate location.

(e) The location of the operating handle and instructions for opening must be shown --

(1) For each passenger emergency exit, by a marking on or near the exit that is readable from a distance of 30 inches; and

(2) For each Type I or Type II passenger emergency exit with a locking mechanism released by rotary motion of the handle, by --

(i) A red arrow, with a shaft at least three-fourths inch wide and a head twice the width of the shaft, extending along at least 70 degrees of arc at a radius approximately equal to three-fourths of the handle length; and

(ii) The word "open" in red letters one inch high, placed horizontally near the head of the arrow.

(f) Each emergency exit that is required to be openable from the outside, and its means of opening, must be marked on the outside of the airplane. In addition, the following apply:

(1) The outside marking for each passenger emergency exit in the side of the fuselage must include a two-inch colored band outlining the exit.

(2) Each outside marking including the band, must have color contrast to be readily distinguishable from the surrounding fuselage surface. The contrast must be such that if the reflectance of the darker color is 15 percent or less, the reflectance of the lighter color must be at least 45 percent. "Reflectance" is the ratio of the luminous flux reflected by a body to the luminous flux it receives. When the reflectance of the darker color is greater than 15 percent, at least a 30 percent difference between its reflectance and the reflectance of the lighter color must be provided.

(3) In the case of exits other than those in the side of the fuselage, such as ventral or tail cone exits, the external means of opening, including instructions if applicable, must be conspicuously marked in red, or bright chrome yellow if the background color is such that red is inconspicuous. When the opening means is located on only one side of the fuselage, a conspicuous marking to that effect must be provided on the other side.

(g) Emergency exits need only be marked with the word "EXIT."

b. Guidance.

(1) Paragraph (c). Compliance with the floor proximity emergency escape path marking requirements of § 25.812(e) is also considered compliance with the requirements of this section.

(2) Paragraph (f). Exit bands are not required for "flightcrew only" exits or other emergency exits not in the sides of the fuselage.

384. AMENDMENT 25-32, Effective May 1, 1972.

a. Change to Regulation.

(d) The location of each passenger emergency exit must be indicated by a sign visible to occupants approaching along the main passenger aisle (or aisles). There must be --

(1) A passenger emergency exit locator sign above the aisle (or aisles) near each passenger emergency exit, or at another overhead location if it is more practical because of low headroom, except that one sign may serve more than one exit if each exit can be seen readily from the sign;

(2) A passenger emergency exit marking sign next to each passenger emergency exit, except that one sign may serve two such exits if they both can be seen readily from the sign; and

(3) A sign on each bulkhead or divider that prevents fore and aft vision along the passenger cabin to indicate emergency exits beyond and obscured by the bulkhead or divider, except that if this is not possible the sign may be placed at another appropriate location.

(e) The location of the operating handle and instructions for opening the exit from the inside must be shown as follows:

(1) For each passenger emergency exit, by a marking on or near the exit that is readable from a distance of 30 inches. In addition, the operating handle for each Type III passenger emergency exit must be self-illuminated with an initial brightness of at least 160 microlamberts. If the operating handle is covered, self-illuminated cover removal instructions having an initial brightness of at least 160 microlamberts must also be provided.

(2) For each Type A, Type I or Type II passenger emergency exit with a locking mechanism released by rotary motion of the handle, by --

(i) A red arrow, with a shaft at least three-fourths inch wide and a head twice the width of the shaft, extending along at least 70 degrees of arc at a radius approximately equal to three-fourths of the handle length; and

(ii) The word "open" in red letters one inch high, placed horizontally near the head of the arrow.

(g) Each sign required by paragraph (d) of this section may use the word "exit" in its legend in place of the term "emergency exit".

b. Guidance.

(1) Paragraph (d). The signs required by paragraphs (d)(1), (2) and (3) are intended to be independent and serve different functions. However, certain cabin arrangements might permit a single sign to serve the functions of both paragraph (d)(1) and (3). If such an arrangement were presented, the sign should meet the contrast and brightness requirements of § 25.812(b)(1)(i) and should be in close proximity to the exits concerned. Compliance with both § 25.811(d)(1) and (3) is required regardless of the number of signs employed.

(2) Paragraph (d). Similar to the guidance immediately above, certain arrangements and especially small cabin sizes might permit a single sign to serve both the locator and marker sign functions of paragraphs (d)(1) and (d)(2). If such a proposal was presented, the proposal should address all pertinent requirements of § 25.812, and it should be demonstrated that the sign satisfactorily performs both marker and locator sign functions.

(3) Paragraph (d)(2). Prior to Amendment 25-32, the exit marking sign of § 25.811(d)(2) was referred to as a locator sign in § 25.811(d)(2) for floor level exits. The locator sign requirement of § 25.811(d)(1) for floor level exits was introduced by Amendment 25-32.

385. AMENDMENT 25-46, Effective December 1, 1978.

a. Change to Regulation.

(e) The location of the operating handle and instructions for opening exits from the inside of the airplane must be shown in the following manner:

(1) Each passenger emergency exit must have, on or near the exit, a marking that is readable from a distance of 30 inches.

(2) Each Type I and Type A passenger emergency exit operating handle must --

(i) Be self-illuminated with an initial brightness of at least 160 microlamberts; or

(ii) Be conspicuously located and well illuminated by the emergency lighting even in conditions of occupant crowding at the exit.

(3) Each Type III passenger emergency exit operating handle must be self-illuminated with an initial brightness of at least 160 microlamberts. If the operating handle is covered, self-illuminated cover removal instructions having an initial brightness of at least 160 microlamberts must also be provided.

(4) Each Type A, Type I, and Type II passenger emergency exit with a locking mechanism released by rotary motion of the handle must be marked --

(i) With a red arrow, with a shaft at least three-fourths of an inch wide and a head twice the width of the shaft, extending along at least 70 degrees of arc at a radius approximately equal to three-fourths of the handle length.

(ii) So that the centerline of the exit handle is within ± 1 inch of the projected point of the arrow when the handle has reached full travel and has released the locking mechanism, and

(iii) With the word "open" in red letters 1 inch high, placed horizontally near the head of the arrow.

b. Guidance. There is no additional guidance for this amendment.

386 - 390. [RESERVED]

SECTION 25.812 EMERGENCY LIGHTING

391. Section 25.812 Did Not Exist Prior to Amendment 25-15.

392. AMENDMENT 25-15, Effective October 24, 1967.

a. Regulation.

(a) An emergency lighting system, independent of the main lighting system, must be installed which includes:

(1) Illuminated emergency exit marking and locating signs, sources of general cabin illumination, and interior lighting in emergency exit areas.

(2) Exterior emergency lighting.

(b) Each passenger exit sign and each exit locating sign must have white letters at least 1 inch high on a red background at least 2 inches high. These signs may be internally electrically illuminated, or self-illuminated by other than electrical means, with an initial brightness of at least 160 microlamberts. The colors may be reversed in the case of internally electrically illuminated signs if this will increase the illumination of the exit.

(c) General illumination in the passenger cabin must be provided so that when measured along the centerline of main passenger aisles at seat armrest height and at 40-inch intervals, the average illumination is not less than 0.05 foot-candle. A main passenger aisle is considered to extend along the fuselage from the most forward passenger emergency exit or cabin occupant seat, whichever is farther forward, to the most rearward passenger emergency exit or cabin occupant seat, whichever is farther aft.

(d) The floor of the passageway leading to each floor-level passenger emergency exit, between the main aisles and the exit openings, must be provided with illumination.

(e) The emergency lighting system is to be designed as follows:

(1) The lights must be operable manually from the flightcrew station and (if required by the operating rules of this chapter) from a point in the passenger compartment that is readily accessible to the flight attendant seat. Means are to be provided to safeguard against inadvertent operation of the manual controls.

(2) When armed or turned on, the lights must remain lighted or become lighted upon interruption (except an interruption caused by a vertical separation of the fuselage during crash landing) of the airplane's normal electric power.

(f) Exterior emergency lighting must be provided at each overwing exit so that the illumination is --

(1) Not less than 0.02 foot-candle (measured on a plane parallel to the surface) on a 2-square-foot area where an evacuee is likely to make his first step outside the cabin:

(2) Not less than 0.05 foot-candle (measured normal to the direction of the incident light) for a minimum width of 2 feet along the 30 percent of the slip-resistant escape route required in § 25.803(e) that is farthest from the exit; and

(3) Not less than 0.02 foot-candle on the ground surface with the landing gear extended (measured on a horizontal plane) where an evacuee using the established escape route would normally make first contact with the ground.

(g) The means required in § 25.809(f)(1) and (h) to assist the occupants in descending to the ground must be illuminated so that the deployed assist means is visible from the airplane.

(1) If the assist means is illuminated by exterior emergency lighting, it must provide -

(i) Illumination at each overwing emergency exit of not less than 0.02 foot-candle on the ground surface with the landing gear extended (measured in a horizontal plane) where an evacuee using the established escape route would normally make first contact with the ground; and

(ii) Illumination at each non-overwing emergency exit, of not less than 0.03 foot-candle (measured normal to the direction of the incident light) at the ground end of the assist means and, for each non-over-wing exit in the side of the fuselage, over a spherical surface 10 degrees to either side of the center of the assist means and from 30 degrees above to 5 degrees below the 45 degree position of the assist means.

(2) If the assist means is self-illuminated, the lighting provisions --

(i) May not be adversely affected by stowage; and

(ii) Must provide sufficient ground surface illumination so that obstacles at the end of the assist means are clearly visible to evacuees.

(h) The energy supply to each emergency lighting unit must provide the required level of illumination for at least 10 minutes at the critical ambient conditions after emergency landing.

(i) If storage batteries are used as the energy supply for the emergency lighting system, they may be recharged from the airplane's main electric power system

provided that the charging circuit is designed to preclude inadvertent battery discharge into charging circuit faults.

(j) Components of the emergency lighting system, including batteries, wiring relays, lamps, and switches, must be capable of normal operation after having been subjected to the inertia forces listed in § 25.561(b).

(k) The emergency lighting system must be designed so that after any single vertical separation of the fuselage during crash landing --

(1) Not more than 25 percent of all electrically illuminated emergency lights required by this section are rendered inoperative in addition to the lights that are directly damaged by the separation;

(2) Each electrically illuminated exit sign required under § 25.811(d)(2) remains operative exclusive of those that are directly damaged by the separation; and

(3) At least one required exterior emergency exit light for each side of the airplane remains operative exclusive of those that are directly damaged by the separation.

b. Guidance.

(1) Paragraph (b). Advisory Circular 20-38A, Measurement of Cabin Interior Emergency Illumination in Transport Airplanes, provides guidance material for the minimum measurements required by this paragraph.

(2) Paragraph (c).

(i) Required illumination levels for main aisles also apply to cross aisles (later incorporated by Amendment 25-32) that are required to meet § 25.807(a)(7)(v). Cross aisles that are in excess of those required need not be provided with emergency lighting.

(ii) When measuring the illumination levels required by this paragraph, the interior color scheme (sidewalls, seat covers, floor covering, etc.) should be evaluated for its reflective contribution to the illumination level. This may be accomplished by negating the contribution of reflected light and demonstrating the minimum illumination levels independent of reflected light. If the reflective contribution is known, subsequent interiors of different reflectivity may be analyzed to show the effect on illumination levels is not detrimental.

(3) Paragraph (f)(1). The illumination level at an overwing escape route where the evacuee would take his first step outside the airplane may be measured with the exit unobstructed. It is not necessary to consider an evacuee standing in the exit opening when measuring illumination levels. Transient blocking of the wing contact area illumination as an evacuee passes through the exit is acceptable provided no adverse effects are observed during the demonstration required by § 25.803(c).

(4) Paragraph (g). Illumination of the overwing escape path or an assist means at any exit should be automatically activated as part of the airplane emergency lighting system, or by the action of opening the exit. The required exterior lighting at an exit may not be dependent on the operation of another exit.

(5) Paragraph (h). When the airplane is exposed to the critical minimum and maximum ambient temperatures such that the airplane is in equilibrium, the airplane environmental systems may be used to condition the airplane prior to boarding passengers. The temperature of the power supplies may be determined following a reasonable conditioning period to obtain operation voltage when the airplane is at the critical outside ambient temperature. The illumination may then be measured assuming ten-minute operation from these initial conditions. If an applicant is unable to furnish what initial conditions are, it is acceptable to use Radio Technical Commission for Aeronautics Document No. RTCA/DO-160B, entitled "Environmental Conditions and Test Procedures for Airborne Equipment," for low and high temperature tests. An additional alternate set of satisfactory environmental conditions may be found in AC 25.812-1A.

(6) Paragraph (k) A transverse separation is considered to occur at any fuselage station, irrespective of the perceived likelihood that a separation could occur there. “Separation” in this context refers to all degrees of fuselage separation such that the emergency lighting system is interrupted, and not just separations that result in two distinct segments of fuselage.

(7) Paragraph (k)(1). This paragraph is based on the number of electrically illuminated lights required to meet the illumination levels of this section. Exit signs which are not used to contribute to cabin illumination and subsystems provided in accordance with paragraph (g)(2) do not apply to this paragraph. However, an applicant should not be penalized for providing lights in excess of the number required.

(8) Paragraph (k)(2). “Directly damaged,” as used in this paragraph, refers to a sign that is located at the same station as a transverse fuselage separation or, between the frames bounding the separation location, and therefore rendered inoperative. The sign is also considered inoperative if the separation occurs at the same station as any part of the power supply. The sign should remain operative unless it is 'directly damaged' or the separation renders the exit unopenable. Therefore, the power supply should be located at a station between the frames that make up the exit, or in the case of a sign beside the exit, the power supply may also be at the same fuselage station as any part of the sign.

393. AMENDMENT 25-28, Effective September 25, 1971.

a. Change to Regulation.

(e) Except for subsystems provided in accordance with paragraph (g) of this section that serve no more than one assist means, are independent of the airplane's main emergency lighting system, and are automatically activated when the assist means is deployed, the emergency lighting system must be designed as follows:

(g)(2) If the emergency lighting subsystem illuminating the assist means serves no other assist means, is independent of the airplane's main emergency lighting system, and is automatically activated when the assist means is deployed, the lighting provisions --

b. Guidance. There is no additional guidance for this amendment.

394. AMENDMENT 25-32, Effective May 1, 1972.

a. Change to Regulation.

(a) An emergency lighting system, independent of the main lighting system, must be installed. However, the sources of general cabin illumination may be common to both the emergency and the main lighting systems if the power supply to the emergency lighting system is independent of the power supply to the main lighting system. The emergency lighting system must include:

(1) Illuminated emergency exit marking and locating signs, sources of general cabin illumination, and interior lighting in emergency exit areas.

(2) Exterior emergency lighting.

(b) Emergency exit signs --

(1) For airplanes that have a passenger seating configuration, excluding pilot seats, of 10 seats or more, must meet the following requirements:

(i) Each passenger emergency exit locator sign required by § 25.811(d)(1) and each passenger emergency exit marking sign required by § 25.811(d)(2) must have red letters at least 1 1/2 inches high on an illuminated white background, and must have an area of at least 21 square inches excluding the letters. The lighted background-to-letter contrast must be at least 10:1. The letter height to stroke-width ratio may not be more than 7:1 nor less than 6:1. These signs must be internally electrically illuminated with a background brightness of at least 25 foot-lamberts and a high-to-low background contrast no greater than 3:1.

(ii) Each passenger emergency exit sign required by § 25.811(d)(3) must have red letters at least 1 1/2 inches high on a white background having an area of at least 21 square inches excluding the letters. These signs must be internally, electrically illuminated or self-illuminated by other than electrical means and must have an initial brightness of at least 400 micro-lamberts. The colors may be reversed in the case of a sign that is self-illuminated by other than electrical means.

(2) For airplanes that have a passenger seating configuration, excluding pilot seats, of nine seats or less, that are required by § 25.811(d)(1), (2), and (3), must have red letters at least 1 inch high on a white background at least 2

inches high. These signs may be internally electrically illuminated or self-illuminated by other than electrical means, with an initial brightness of at least 160 microlamberts. The colors may be reversed in the case of a sign that is self-illuminated by other than electrical means.

(c) General illumination in the passenger cabin must be provided so that when measured along the centerline of main passenger aisle(s), and cross aisle(s) between main aisles, at seat armrest height and at 40-inch intervals, the average illumination is not less than 0.05 foot-candle and the illumination at each 40-inch interval is not less than 0.01 foot-candle. A main passenger aisle(s) is considered to extend along the fuselage from the most forward passenger emergency exit or cabin occupant seat, whichever is farther forward, to the most rearward passenger emergency exit or cabin occupant seat, whichever is farther aft.

(d) The floor of the passageway leading to each floor-level passenger emergency exit, between the main aisles and the exit openings, must be provided with illumination that is not less than 0.02 foot-candle measured along a line that is within six inches of and parallel to the floor and is centered on the passenger evacuation path.

(e) Except for subsystems provided in accordance with paragraph (g) of this section, that serve no more than one assist means, are independent of the airplane's main emergency lighting system, and are automatically activated when the assist means is erected, the emergency lighting system must be designed as follows:

(1) The lights must be operable manually from the flightcrew station and (if required by the operating rules of this chapter) from a point in the passenger compartment that is readily accessible to a normal flight attendant seat.

(2) There must be a flightcrew warning light which illuminates when power is on in the airplane and emergency lighting control device is neither armed nor turned on.

(3) When armed or turned on, the lights must remain lighted or become lighted upon interruption (except an interruption caused by a transverse vertical separation of the fuselage during crash landing) of the airplane's normal electric power (ref. § 25.1351(d)). There must be means to safeguard against inadvertent operation of the control device from the "armed" or "on" position.

(f) Exterior emergency lighting must be provided as follows:

(1) At each overwing emergency exit the illumination must be --

(i) Not less than 0.03 foot-candle (measured normal to the direction of the incident light) on a two-square-foot area where an evacuee is likely to make his first step outside the cabin;

(ii) Not less than 0.05 foot-candle (measured normal to the direction of the incident light) for a minimum width of 42 inches for a Type A overwing emergency exit and of 2 feet for all other overwing emergency exits along the 30 percent of the slip-resistant portion of the escape route required in § 25.803(e) that is farthest from the exit; and

(iii) Not less than 0.03 foot-candle on the ground surface with the landing gear extended (measured normal to the direction of the incident light) where an evacuee using the established escape route would normally make first contact with the ground.

(2) At each non-overwing emergency exit not required by § 25.809(f) to have descent assist means the illumination must be not less than 0.03 foot-candle (measured normal to the direction of the incident light) on the ground surface with the landing gear extended where an evacuee is likely to make his first contact with the ground outside the cabin.

(g) The means required in § 25.809(f)(1) and (h) to assist the occupants in descending to the ground must be illuminated so that the erected assist means is visible from the airplane. In addition --

(1) If the assist means is illuminated by exterior emergency lighting, it must provide illumination of not less than 0.03 foot-candle (measured normal to the direction of the incident light) at the ground end of the erected assist means where an evacuee using the established escape route would normally make first contact with the ground, with the airplane in each of the attitudes corresponding to the collapse of one or more legs of the landing gear.

(2) If the emergency lighting subsystem illuminating the assist means serves no other assist means, is independent of the airplane's main emergency lighting system, and is automatically activated when the assist means is erected, the lighting provisions --

(i) May not be adversely affected by stowage; and

(ii) Must provide illumination of not less than 0.03 foot-candle (measured normal to the direction of incident light) at the ground end of the erected assist means where an evacuee would normally make first contact with the ground, with the airplane in each of the attitudes corresponding to the collapse of one or more legs of the landing gear.

(k)(3) At least one required exterior emergency light for each side of the airplane remains operative exclusive of those that are directly damaged by the separation.

b. Guidance.

(1) Paragraph (b)(1). The wording “a passenger seating configuration, excluding pilot seats, of 10 seats or more,” which was promulgated with the intent of being consistent with Amendment 23-10 to part 23, does not directly address seats intended for use by observers or flight attendants. Seats approved for use by observers or flight attendants are not included in the passenger seating configuration.

(2) Paragraphs (g)(1) and (g)(2)(ii). With one or more landing gear legs collapsed, the resultant position of the assist means should be evaluated so that it does not obscure the illumination at the point of evacuees first ground contact. Under such conditions the likely point of contact may change, depending upon the specific collapsed landing gear case. The emergency lighting system must provide for these changes.

395. AMENDMENT 25-46, Effective December 1, 1978.

a. Change to Regulation.

(e)(1) The lights must be operable manually from the flightcrew station and from a point in the passenger compartment that is readily accessible to a normal flight attendant seat.

(2) There must be a flightcrew warning light which illuminates when power is on in the airplane and the emergency lighting control device control device is not armed.

(3) The cockpit control device must have an "on," "off," and "armed" position so that when armed in the cockpit or turned on at either the cockpit or flight attendant station the lights will either light or remain lighted upon interruption (except an interruption caused by a transverse vertical separation of the fuselage during crash landing) of the airplane's normal electric power. There must be a means to safeguard against inadvertent operation of the control device from the "armed" or "on" positions.

b. Guidance. Paragraph (e)(1). The emergency lighting switch in the cabin cannot turn off the system once it is activated. This switch should activate the system, however, even if the switch in the cockpit is “off.”

396. AMENDMENT 25-58, Effective November 26, 1984.

a. Change to Regulation.

(a)(1) Illuminated emergency exit marking and locating signs, sources of general cabin illumination, interior lighting in emergency exit areas, and floor proximity escape path marking.

(e) Floor proximity emergency escape path marking must provide emergency evacuation guidance for passengers when all sources for illumination more than 4 feet above the cabin aisle floor are totally obscured. In the dark of the night, the floor proximity emergency escape path marking must enable each passenger to--

(i) After leaving the passenger seat, visually identify the emergency escape path along the cabin aisle floor to the first exits or pair of exits forward and aft of the seat; and

(ii) Readily identify each exit from the emergency escape path by reference only to markings and visual features not more than 4 feet above the cabin floor.

b. Guidance. NOTE: This change replaced the existing paragraph (e) with a new paragraph (e) and relettered existing paragraphs (e) through (k) as (f) through (l).

(1) Paragraph (e). The floor proximity emergency escape path marking system is included as part of the emergency lighting system when determining compliance with the separation requirements of paragraph (k).

(2) Paragraph (e). See AC 25.812-1A, Floor Proximity Emergency Escape Path Marking and AC 25.812-2, Floor Proximity Emergency Escape Path Marking Systems Incorporating Photoluminescent Elements.

397 - 410. [RESERVED]

411. REGULATION IN EFFECT AT ADOPTION OF PART 25.

a. Regulation.

(a) Except as provided in § 25.803(c) with regard to passageways between individual compartments, each passageway between individual passenger areas, and passageways leading to Type I and Type II emergency exits, must be unobstructed and at least 20 inches wide.

(b) For each emergency exit covered by § 25.809(f), there must be enough space adjacent to that exit to allow a crewmember to assist in the evacuation of passengers without reducing the unobstructed width of the passageway below that required for that exit.

(c) There must be access from the main aisle to each Type III and Type IV exit. The access may not be obstructed by seats, berths, or other protrusions, to an extent that would reduce the effectiveness of the exit. However, there may be minor obstructions if there are compensating factors to maintain the effectiveness of the exit.

(d) If it is necessary to pass through a doorway to reach any required emergency exit from any seat in the passenger cabin, the door must have a means to latch it in the open position.

b. Guidance.

(1) Paragraph (a). Attendant seating facilities should not normally result in any reduction in required aisle widths, passageways between compartments, or the minimum 20-inch passageway leading to Type I and II exits. Attendants seating facilities provided with any acceptable means of clearing the passageway immediately is not considered as being an obstruction to these passageways. An acceptable means of demonstrating compliance would be a spring loaded attendant seat which provides automatic retraction when the seat is vacated.

(2) Paragraph (a). In determining the 20-inch passageway requirements leading to Type I and Type II exits:

(i) The presence of passenger feet need not be considered.

(ii) Curtain tie-backs with appropriate placards may be required to maintain an unobstructed passageway.

(iii) Seat backs of seats facing the passageway with breakover feature should remain clear of the required passageway when placed in breakover position.

(iv) Recline into the required passageway is permitted if the seatback does not preclude opening the exit and if the passageway is located between rows of seats.

(v) No seat cushion compression and no breakover from the upright position of a seat facing away from the passageway should be allowed to achieve the required passageway.

(vi) The passageway may be offset from the projected exit opening if the effectiveness of the exit is not reduced.

(vii) Galley, lavatory or closet doors, drawers, shelves, etc., that obstruct the required passageway, should be placarded to be stowed and/or latched for taxi, takeoff and landing or be spring-loaded closed.

(viii) Galley and stowage unit doors, drawers, etc., that interfere with the opening of an emergency exit should be spring-loaded closed. The evaluation for interference is made with the stowage unit door in any position and opening the emergency exit from either the inside or the outside. If it is not possible to spring-load the door, drawer, etc., there should be a special emphasis placard to close and latch for taxi, takeoff, and landing. (See paragraph 1041b(6).)

(3) Paragraph (a). For excess Type I and Type II exits (See AC 20-60, Accessibility to Excess Emergency Exits), access shall be provided from the aisle by one of the following:

(i) By means of an unobstructed 20-inch passageway.

(ii) By means of an unobstructed passageway 20 inches wide at the outboard seat location and 15 inches wide at the inboard seat location.

(iii) By removing the outboard seat nearest the centerline of the exit and establishing two unobstructed 8-inch passageways.

(4) Paragraph (b). When it is required that there be an area adjacent to an exit to permit a crewmember to assist passengers in the use of escape devices, a 12 x 20-inch assist space with the long dimension parallel to and clear of the required 20-inch exit approach passageway or equivalent facility should be provided. The area should be adequate to permit an attendant to stand erect and to perform needed assist services in the evacuation of passengers. Minor deviations from the 12 X 20-inch assist space are permitted if an evaluation is made that the effectiveness of the exit is not reduced. A demonstration may be necessary to show that passengers can be effectively evacuated.

(5) Paragraph (b). Seat breakover should not be used to clear the assist space. Recline into the assist space and cushion compression are permitted, if the seat is easily pushed forward, and the cushion readily compressible.

(6) Paragraph (b). If the assist space is under the overhead bins such that the attendant cannot stand erect, additional space, such as removal of the outboard seat, is required. The effectiveness of the assist space must be demonstrated.

(7) Paragraph (b). The assist space need not be directly adjacent to the exit. In some cases the assist space could be inboard a short distance from the exit but outboard of the main aisle.

(8) Paragraph (b) Assist handles are often provided at floor level emergency exits to provide stability for the flight attendant during an emergency evacuation. There is no specific requirement to provide an assist handle however, where an assist handle has been utilized for an evacuation demonstration used to show compliance with the regulations, production airplanes should also have an assist handle. The assist handle should be located at the assist space, even if the location of the assist space is not the same as the location on the airplane used for the evacuation demonstration.

(8) Paragraph (c). Projection of the seat backs into the minimum required exit opening should be permitted only if the seat back can be pushed forward or aft to clear the opening with the seat occupied. The force required to push the seat back away from the opening should be as low as practicable and should not exceed a maximum of 35 pounds with the seat unoccupied. The action should not require operation of any mechanical release. (See paragraph 81b(6) for minimum breakover force.) A clear opening should permit the required minimum exit shape to be projected inward past the seat bottom and back cushion. Minor protrusion of the seat upholstery is acceptable if it does not interfere with exit removal and if it could be compressed without special effort by the person(s) using the exit.

(9) Paragraph (c). Armrests, curtains, or other protuberances which are removed simultaneously with opening of the exit are not considered to restrict the required minimum opening.

(10) Paragraph (c). Berth installations, whether or not made up, should not decrease the accessibility and utility of emergency exits.

(11) Paragraph (c). Seat back recline or breakover should not render the exit unopenable from either inside or outside.

(12) Paragraph (c). An armrest should not protrude into the projected opening of the required exit, even if it could be rotated out of the projected exit opening.

(13) Paragraph (c). A minor protrusion, not to exceed two inches, of the outboard seat cushion into the required exit opening is permitted, if the cushion is easily compressed. A force of 170 pounds distributed over 40 square inches has been found acceptable to determine if the cushion is easily compressed.

412. AMENDMENT 25-1, Effective June 7, 1965.

a. Change to Regulation.

(a) Each passageway between individual passenger areas, or leading to a Type I or Type II emergency exit must be unobstructed and at least 20 inches wide.

(b) There must be enough space next to each Type I or Type II emergency exit to allow a crewmember to assist in the evacuation of passengers without reducing the unobstructed width of the passageway to the exit below that required by paragraph (a) of this section.

(c) There must be access from the main aisle to each Type III or Type IV exit. The access may not be obstructed by seats, berths, or other protrusions to an extent that would reduce the effectiveness of the exit. However, there may be minor obstructions if there are compensatory factors to maintain the effectiveness of the exit.

(d) If it is necessary to pass through a passageway between passenger compartments to reach any required emergency exit from any seat in the passenger cabin, the passageway must be unobstructed. However, curtains may be used if they allow free entry through the passageway.

(e) No door may be installed in any partition between passenger compartments.

(f) If it is necessary to pass through a doorway separating the passenger cabin from other areas to reach any required emergency exit from any passenger seat, the door must have a means to latch it in open position. The latching means must be able to withstand the loads imposed upon it when the door is subjected to the ultimate inertia forces, relative to the surrounding structure, listed in § 25.561(b).

b. Guidance.

(1) Paragraph (d). The curtains may protrude slightly into the required passageway, provided the curtain and its tie-backs do no inhibit passage.

(2) Paragraph (e). Arrangements have been found acceptable for a lavatory door where the lavatory would be occupied by one passenger during taxi, takeoff and landing. This arrangement would require an equivalent level of safety finding. The door should be secured open for taxi, takeoff and landing and be provided with an emergency egress panel. An emergency egress panel is a panel that can be broken through by a passenger who may be inadvertently trapped behind the door. A demonstration should be done using a fifth percentile female subject (approximately 60 inches tall and weighing 102 pounds).

(3) Paragraph (e). Curtains within a sliding frame are not considered to be a door if a person can easily pass through the curtain when closed. The curtain should be fastened open for taxi, takeoff and landing. (See paragraph 1041b(7).)

(4) Paragraph (e). Doors are permitted on galleys, etc. that are between the main aisle and exit if the door is not between passenger compartments. This would also apply to rooms not occupied for taxi, takeoff and landing. Doors that open into a main aisle should not be permitted in passenger compartments occupiable for taxi, takeoff or landing or in passenger compartments with passenger emergency exits. These types of compartments are typically found in "executive" interiors with the main aisle along the side wall.

413. AMENDMENT 25-15, Effective October 24, 1967.

a. Change to Regulation.

(a) There must be a passageway between individual passenger areas, and leading from each aisle to each Type I and Type II emergency exit. These passageways must be unobstructed and at least 20 inches wide.

(b) For each passenger emergency exit covered by § 25.809(f), there must be enough space next to the exit to allow a crewmember to assist in the evacuation of passengers without reducing the unobstructed width of the passageway below that required for the exit.

(c) There must be access from each aisle to each Type III or Type IV exit. The access must not be obstructed by seats, berths, or other protrusions which would reduce the effectiveness of the exit. However, for airplanes having a maximum passenger seating capacity not exceeding 19, there may be minor obstructions if there are compensatory factors to maintain the effectiveness of the exit. For airplanes having a maximum seating capacity of 20 or more, the projected opening of the exit provided must not be obstructed by a seatback in any position at the outboard seat locations.

b. Guidance.

(1) Paragraph (a). The passageway is the clear space from the floor to ceiling or bottom of the sidewall bins that runs generally perpendicular to the aisle when leading to a Type I or Type II exit.

(2) Paragraph (c). Seat back breakover and recline at the outboard seat locations should have a positive lockout if the seatback protrudes into the projected opening of the exit provided. Special seat identification is required. The projected exit opening is the actual rather than the minimum required opening.

(3) Paragraph (c). Armrests should not protrude into the projected opening of the exit provided.

414. AMENDMENT 25-17, Effective June 20, 1968.

a. Change to Regulation.

(c) There must be access from each aisle to each Type III or Type IV exit. The access must not be obstructed by seats, berths, or other protrusions which would reduce the effectiveness of the exit. However, for airplanes having a maximum passenger seating capacity not exceeding 19, there may be minor obstructions if there are compensatory factors to maintain the effectiveness of the exit. For airplanes having a maximum seating capacity of 20 or more, the projected opening of the exit provided must not be obstructed by a seatback in any position at the outboard seat locations. However, if the lateral distance between an outboard seat and the exit is not less than the width of the narrowest passenger seat installed on the airplane, that seat need not meet the seat back obstruction provision of this paragraph.

b. Guidance. There is no additional guidance for this amendment.

415. AMENDMENT 25-32, Effective May 1, 1972.

a. Change to Regulation.

(c) There must be access from each aisle to each Type III or Type IV exit, and --

(1) For airplanes that have a passenger seating configuration, excluding pilots seats of 20 or more, the projected opening of the exit provided must not be obstructed by seats, berths, or other protrusions (including seatbacks in any position) for a distance from that exit not less than the width of the narrowest passenger seat installed on the airplane;

(2) For airplanes that have a passenger seating configuration, excluding pilots seats, of 19 or less, there may be minor obstructions in this region, if there are compensating factors to maintain the effectiveness of the exit.

b. Guidance.

(1) Paragraph (a). The seat back in any position (breakover or recline) should not obstruct the required 20-inch passageway.

(2) Paragraph (c)(1). All portions of the outboard seat should clear the projected exit opening. No seat cushion compression should be allowed in order to clear the projected exit opening provided.

(3) Paragraph (c)(2). Interior features (galleys, closets, seats, etc.) must not prevent an exit from being opened. Unattached (loose), soft seat-back cushions on side-facing divans, for example, may encroach into the minimum required exit opening provided the cushion can be readily moved away and the exit easily opened from the inside and outside. Other incursions into the projected opening, and even some interference in opening the exit are acceptable for these smaller airplanes, provided the exit maintains its effectiveness, and remains openable. The exit signs may not be obscured..

(4) Paragraphs (c)(1) and (c)(2). The wording “a passenger seating configuration, excluding pilot seats,” which was promulgated with the intent of being consistent with Amendment 23-10 to Part 23, does not directly address seats intended for use by observers or flight attendants. Seats approved for use by observers or flight attendants are not included in the passenger seating configuration.

416. AMENDMENT 25-46, Effective December 1, 1978.

a. Change to Regulation.

(c) There must be access from each aisle to each Type III or Type IV exit, and --

(1) For airplanes that have a passenger seating configuration, excluding pilot's seats, of 20 or more, the projected opening of the exit provided may not be obstructed and there must be no interference in opening the exit by seats, berths, or other protrusions (including seatbacks in any position) for a distance from that exit not less than the width of the narrowest passenger seat installed on the airplane.

b. Guidance. Paragraph (c)(l). The outboard seats, berths, or other protrusions, even though they clear the projected exit opening, should not interfere with the opening of the exit. For example, interior lining or trim may extend beyond the projected opening of the exit, and could interfere with opening of the exit by contacting seats or other structure.

417 - 440. [RESERVED]

SECTION 25.815 WIDTH OF MAIN AISLE

441. REGULATION IN EFFECT AT ADOPTION OF PART 25.

a. Regulation.

The main passenger aisle width at any point between seats must equal or exceed the values in the following table:

Minimum main passenger aisle width

Passenger seating capacity	Less than 25 inches from floor	25 inches and more from floor
	Inches	Inches
10 or less	12	18
11 through 19	12	20
20 or more	15	20

b. Guidance.

(l) The passenger aisle width is the normal distance between opposite seats measured without occupants. The distance should be determined without compression of seat fabric or cushion and with the seats or other aisle constraints in the most adverse position, such as seats reclined or broken over.

(2) When the measurement is not between seats but between other aisle constraints such as galleys, coat closets, storage compartments, etc., the minimum widths at the specified vertical distance above the floor still prevails. Protuberances such as door knobs, latches, rails, etc., should be considered if they encroach the specified aisle width. This measurement should be made using the vertical projection of any protuberance in its appropriate height zone (less than 25 inches from the floor or 25 inches and more from the floor). The effect of the protuberance on the evacuation of the airplane should be considered when determining if it may or may not protrude into the required aisle width. Curtains may protrude slightly into the required aisle, provided the curtain and its tie-back do not inhibit passage.

(3) For staggered seat rows, or zigzag aisles, the aisle width distance may be considered as that measured perpendicular to the aisle pathway at any point along its full path.

(4) Arm rests that swing up, such as those for handicapped persons, may encroach upon the 20-inch width in the up position. If so, the arm rest should automatically return to the down position or be appropriately placarded.

442. AMENDMENT 25-15, Effective October 24, 1967.

a. Change to Regulation.

The passenger aisle width at any point between seats must equal or exceed the values in the following table:

Passenger seating capacity	Minimum main passenger aisle width (inches)	
	Less than 25 inches from floor	25 inches and more from floor
	Inches	Inches
10 or less	12	15
11 through 19	12	20
20 or more	15	20

b. Guidance. There is no additional guidance for this amendment.

443. AMENDMENT 25-38, Effective February 1, 1977.

a. Change to Regulation.

The passenger aisle width at any point between seats must equal or exceed the values in the following table:

Passenger seating capacity	Minimum main passenger aisle width (inches)	
	Less than 25 inches from floor	25 inches and more from floor
	Inches	Inches
10 or less	12*	15
11 through 19	12	20
20 or more	15	20

* A narrower width not less than nine inches may be approved when substantiated by tests found necessary by the Administrator.

b. Guidance.

(1) The above-defined minimum aisle widths consider the adverse effects of possible post-crash seat deflections. The maximum allowed post-crash seat deflections that were developed as part of the dynamic seat requirements of § 25.562 assumed these pre-crash aisle widths. Consequently, any tests that are proposed to substantiate the acceptability of an aisle width that is less than nine inches on airplanes seating ten or less, as allowed above, need to address the additional aisle width reduction due to worst-case post-crash seat deflections.

(2) Part 382 was amended by Amendment 382-3, Nondiscrimination on the Basis of Handicap in Air Travel, effective April 5, 1990, and implements the Air Carrier Access Act of 1986. One effect of this amendment was to require certain operators of certain airplanes to provide within a certain timeframe movable aisle armrests on at least half of passenger aisle seats. The intent of this amendment, which the FAA fully supports, was to increase accessibility for handicapped passengers.) Airplane interiors that are configured to comply with part 382 requirements may have from one-half to all of the aisle passenger seats equipped with movable armrests. Armrests may move in such a manner as to decrease the available aisle width, and should therefore be assessed with those requirements in mind.

(3) The following design options could be considered acceptable means for satisfying the Part 25 concerns due to part 382 implementation:

(i) If the movement of the armrest were not into the required aisle space, there would be no compliance problem.

(ii) If the armrest were to return to the down position, unless held upward by a person, the impact on evacuation would be negligible.

(iii) The armrest could be removable (provided it was positively latched when installed).

(iv) If the hinged armrest was normally fastened down, but had a discreetly located release that a flight attendant could operate in the event there was a need to accommodate a disabled passenger, the installation should be acceptable..

444 - 460. [RESERVED]

SECTION 25.817 MAXIMUM NUMBER OF SEATS ABREAST

461. Section 25.817 Did Not Exist Prior to Amendment 25-15.

462. AMENDMENT 25-15, Effective October 24, 1967.

a. Regulation.

> On airplanes having only one passenger aisle, no more than three seats abreast may be placed on each side of the aisle in any one row.

b. Guidance. On a twin-aisle airplane, a six-place seat assembly could be installed in the center file (column) of seats.

463 - 480. [RESERVED]

SECTION 25.819 LOWER DECK SERVICE COMPARTMENTS (INCLUDING GALLEYS)

481. Section 25.819 Did Not Exist Prior to Amendment 25-53.

482. AMENDMENT 25-53, Effective August 31, 1980.

a. Regulation.

For airplanes with a service compartment located below the main deck, which may be occupied during taxi or flight but not during takeoff or landing, the following apply:

(a) There must be at least two emergency evacuation routes, one at each end of lower deck service compartment, or two having sufficient separation within each compartment, which could be used by each occupant of the lower deck service compartment to rapidly evacuate to the main deck under normal and emergency lighting conditions. The routes must provide for the evacuation of incapacitated persons, with assistance. The use of the evacuation routes may not be dependent on any powered device. The routes must be designed to minimize the possibility of blockage which might result from fire, mechanical or structural failure, or persons standing on top of or against the escape routes. In the event the airplane's main power system or compartment main lighting system should fail, emergency illumination for each lower deck service compartment must be automatically provided.

(b) There must be a means for two-way voice communication between the flight deck and each lower deck service compartment.

(c) There must be an aural emergency alarm system, audible during normal and emergency conditions, to enable crewmembers on the flight deck and at each required floor level emergency exit to alert occupants of each lower deck service compartment of an emergency situation.

(d) There must be a means, readily detectable by occupants of each lower deck service compartment, that indicates when seat belts should be fastened.

(e) If a public address system is installed in the airplane, speakers must be provided in each lower deck service compartment.

(f) For each occupant permitted in a lower deck service compartment, there must be a forward or aft facing seat which meets the requirements of § 25.785(c) and must be able to withstand maximum flight loads when occupied.

(g) For each powered lift system installed between a lower deck service compartment and the main deck for the carriage of persons or equipment, or both, the system must meet the following requirements:

(l) Each lift control switch outside the lift, except emergency stop buttons, must be designed to prevent the activation of the lift if the lift door, or the hatch required by paragraph (g)(3) of this section, or both, are open.

(2) An emergency stop button, that when activated will immediately stop the lift, must be installed within the lift and at each entrance to the lift.

(3) There must be a hatch capable of being used for evacuating persons from the lift that is openable from inside and outside the lift without tools, with the lift in any position.

b. Guidance.

(1) The following should be used for any installation regardless of certification basis:

(i) The installation of a lower deck service compartment normally results in cart restraint locations on both the main and lower decks. At these locations, the carts are normally restrained by a fitting in the floor, commonly called a mushroom. There are two kinds of mushrooms. One is usually retractable, located in an aisle or passageway, and capable of restraining the cart for inflight load conditions only. The other mushroom is usually fixed, located in a galley, lift or cabinet, and generally capable of restraining the cart during taxi, takeoff and landing (TTO+L). If necessary, control of the number of carts allowed on each deck should be provided. For the TTO+L condition, there should be enough TTO+L mushrooms for each cart on the airplane. In order to be assured the carts can be taken to such a mushroom, there should be at least two independently powered and controlled lifts between the main and lower decks. If there are not at least two such lifts, it should be demonstrated by actual test that all carts can be transported up or down between decks. It is acceptable to transport the contents and cart separately by average flight attendants. If two such lifts are not installed and transportablity is not demonstrated, at any given time, there should not be more carts on one deck than there are TTO+L mushrooms. It will be acceptable to have adequate AFM limitations and/or placarding to assure the necessary level of safety. This guidance would be equally applicable if a galley or service compartment is located on a deck above the main deck.

(ii) Remote compartments should have adequate ventilation and conditioned air for all occupants. If the compartment is one in which occupants are working, such as a galley, more than normal ventilation and conditioned air should be supplied than that for a compartment in which the occupants are seated. If carbon dioxide (dry ice) is used in a compartment, additional ventilation may be necessary to demonstrate compliance with § 25.831(b)(2) for all regimes of operation; such as at the gate, taxi, takeoff, climb, cruise, hold and descent.

(2) Paragraph (g)(l). Proximity or micro-switches are normally used to sense that the lift door or hatch is open or closed. These interlock switches should be located so that they cannot be easily or inadvertently overridden or deactivated. Special design considerations should be

given to these switches to minimize the probability of them becoming damaged during normal use.

(3) Paragraph (g)(2). The emergency stop buttons are of prime importance and should be given special design considerations. These buttons should have absolute and complete priority over any other control, failure or lack of control. No matter what condition, failure or sequence of events that have occurred, operation of any emergency stop button should result in stopping of the lift without the ability to override from any other location.

483 - 600. [RESERVED]

SECTION 25.851 FIRE EXTINGUISHERS

601. REGULATION IN EFFECT AT ADOPTION OF PART 25.

a. Regulation.

(a) Hand fire extinguishers. For hand fire extinguishers the following apply:

(l) Each hand fire extinguisher must be approved.

(2) The types and quantities of each extinguishing agent used must be appropriate to the kinds of fires likely to occur where used.

(3) Each extinguisher for use in a personnel compartment must be designed to minimize the hazard of toxic gas concentrations.

(4) A readily accessible hand fire extinguisher must be available for use in each Class A or Class B cargo compartment.

(b) Built-in fire extinguishers. If a built-in fire extinguishing system is required --

(l) The capacity of each system, in relation to the volume of the compartment where used and the ventilation rate, must be adequate for any fire likely to occur in that compartment; and

(2) Each system must be installed so that --

(i) No extinguishing agent likely to enter personnel compartments will be hazardous to the occupants; and

(ii) No discharge of the extinguisher can cause structural damage.

b. Guidance.

(l) Standards for approval. An approved type fire extinguisher includes those approved by the Underwriters' Laboratories, Inc., Factory Mutual Laboratories, Underwriters' Laboratories of Canada, or any other agency deemed qualified by the Administrator, or approved by the Administrator in accordance with the provisions of § 21.301.

(2) General. When selecting a hand fire extinguisher for use in airplanes, consideration should be given to the most appropriate extinguishing agent for the type and location of fires likely to be encountered. At least one extinguisher appropriate for a Class A fire should be provided. Consideration should also be given to the agent's ratio of extinguishing ability to quantity required, toxicity, corrosive properties, freezing point, and to the unit's gross weight, ease of operation, and maintenance requirements. Airplane hand fire extinguishers using agents

having a rating in toxicity Group 4 or under should not be installed in airplanes for which an application for a type certificate was made on or after March 5, 1952.

NOTE: The toxicity ratings listed by the Underwriters' Laboratories and the halon and freon number for some of the commonly known fire extinguisher chemicals are as follows:

	Group Number	Halon Number*	Freon Number
Bromochloromethane	3	1011	------
Bromotrifluoromethane	6	1301	13B1/FE1301
Carbon dioxide	5	------	------
Carbon tetrachloride	3	1040	------
Dibromodifluoromethane	4	1202	12B2
Methyl bromide	2	1001	------

* The halon number is defined as follows: the first number is the number of carbon atoms; the second, fluorine; the third, chlorine; and the fourth, bromine in the agent's chemical formula.

Some older transport category airplanes, due to their type certification bases, are not required to comply with § 25.851. For such airplanes, it is recommended that hand fire extinguishers employing agents in toxicity Group 4 or higher be installed when renewing or replacing hand fire extinguishers employing toxic agents.

(3) Types of extinguishers.

(i) Carbon dioxide extinguishers. Carbon dioxide extinguishers are acceptable when the principal hazard is a Class B or Class C fire. Carbon dioxide portable installations should not exceed five pounds of agent per unit to ensure extinguisher portability and to minimize crew compartment carbon dioxide (CO_2) concentrations.

(ii) Water extinguishers. Water extinguishers are acceptable when the principal hazard is a Class A fire and where a fire might smolder if attacked solely by such agents as CO_2 or dry chemical.

(iii) Vaporizing liquid extinguishers. Vaporizing liquid type fire extinguishers are acceptable when the principal hazard is a Class B or Class C fire.

(iv) Dry chemical extinguishers. Dry chemical extinguishers are acceptable where the principal hazard is a Class B or Class C fire. The extinguisher should not be used in crew compartments because of interference with visibility during discharge and because of the possibility of the nonconductive powders being discharged on electrical contacts not otherwise involved.

NOTE: Carbon dioxide is noncorrosive and will not injure food or fabric. Extinguishers must be winterized if they are to operate at temperatures below minus 40° F. Approved unit capacity ranges upwards from two pounds. These extinguishers have only limited value for the

extinguishment of Class A fire, the action of the agent being to blanket the fire by excluding oxygen. Certain antifreeze agents may be corrosive. Approved extinguishers are either protected against freezing to minus 40° F. or must be handled as any other unprotected water on the airplane. Technical Standard Order (TSO)-C19a covers a minimum l-3/8 quart capacity approved water extinguisher. Water extinguishers of the kinds currently on the market are not acceptable for flammable liquid or electrical fires.

Vaporizing liquid extinguisher agents are not normally corrosive to airplane structure and approved units will be satisfactorily protected against freezing to at least minus 40° F. Up to the effective date of this guidance, no vaporizing liquid extinguisher with Underwriters' Laboratories toxicity rating higher than Group 4 is commercially available. Approved units have a minimum capacity of one quart. They are of only limited value for the extinguishment of Class A fires, having a cooling effect of about one-tenth that of water. When using dry chemical extinguishers the powder is nontoxic and noncorrosive, and approved units are protected against freezing to at least minus 40° F. Minimum capacity of approved units is two pounds.

(4) Class of fires.

(i) Class A fires. Fires in ordinary combustible materials where the quenching and cooling effects of quantities of water, or solutions containing large percentages of water, are of first importance.

(ii) Class B fires. Fires in flammable liquids, greases, etc., where a blanketing effect is essential.

(iii) Class C fires. Fires in electrical equipment, where the use of a nonconducting extinguishing agent is of first importance.

(5) For further guidance, refer to National Fire Protection Association, "Standards for Portable Fire Extinguishers," NFPA 10.

(6) Halon 1211 extinguishers may be used in lieu of water fire extinguisher to combat Class A fires, provided a sufficient amount of agent is installed, i.e., 5 lbs. of Halon 1211. For airplanes with passenger capacities between 7 and 30, one extinguisher is sufficient, if it is a 5-lb. or larger Halon 1211 extinguisher. Alternatively, two Halon 1211 extinguishers with 2-1/2 lbs. or more of agent each, or one 2-1/2 lb. Halon 1211 and one water fire extinguisher are sufficient.

602. AMENDMENT 25-54, Effective October 14, 1980.

a. Change to Regulation.

(5) There must be at least the following number of hand fire extinguishers conveniently located in passenger compartments:

Passenger capacity	Minimum number of hand fire extinguishers
7 through 30	l
31 through 60	2
61 or more	3

(6) There must be at least one hand fire extinguisher conveniently located in the pilot compartment.

b. Guidance. The quantities of extinguishers noted above are the absolute minimum permitted. Virtually all airplanes with 61 or more passengers will require additional extinguishers due to interior amenities (galleys, lavatories etc.) and division of cabins. See AC 20-42C, Hand Fire Extinguishers for use in Aircraft, for guidance on acceptable fire extinguishers.

603-620. [RESERVED]

SECTION 25.853 COMPARTMENT INTERIORS

621. REGULATION IN EFFECT AT ADOPTION OF PART 25.

a. Regulation.

For each compartment to be used by the crew or passengers --

(a) The materials must be at least flash-resistant;

(b) The wall and ceiling linings, and the covering of upholstery, floors, and furnishings must be at least flame resistant;

(c) Each compartment where smoking is to be allowed must have self-contained, removable ash trays, and each other compartment must be placarded against smoking;

(d) Each receptacle for towels, paper, or waste must be at least fire resistant and must have means for containing possible fires;

(e) There must be at least one hand fire extinguisher for use by the flight crewmembers; and

(f) There must be at least the following number of hand fire extinguishers conveniently located in passenger compartments:

Passenger capacity	Minimum number of hand fire extinguishers
7 through 30	l
31 through 60	2
61 or more	3

b. Guidance.

(l) Certification by a material manufacturer/supplier, commonly called certs, that a material complies with the flammability requirements of § 25.853 does not satisfy FAA rules. All flammability tests to demonstrate compliance should be witnessed by the FAA or their representatives. See § 25.1359(d) for guidance relative to wiring.

(2) Paragraphs (a) and (b). Definitions and procedures for conducting tests were contained in Flight Standards Service Release (FSSR) No. 453. This FSSR was canceled by AC 00-20, Cancellation of Flight Standards Service Releases, effective 9/7/66, but the FSSR was never replaced by an AC. The following was derived from FSSR 453, and still should be used for those airplanes whose certification bases included it:

Fire Prevention Test Procedure for Aircraft Materials

Fireproof Materials

The following test is considered acceptable for demonstrating compliance with §§ 27.861 and 29.861 (CAR §§ 6.384 and 7.384), with respect to those portions which refer to fireproof materials. All structure, controls, rotor mechanism, and other parts essential to a controlled landing should be capable of resisting flame penetration and remain capable of carrying the loads and satisfactorily performing the function for which they are designed when subject to a test flame of 2000 ± 50° F. flame for l5 minutes.

l. Sheet materials should be tested by subjecting the test flame to a test specimen of approximately l0 inches square. The test flame should be applied at the center of the specimen and be of sufficient size to maintain the required temperature over an area approximately five inches square.

2. Lines, fittings, controls, and other essential components should be enveloped in the test flame on the side that would be exposed in case of a fire when mounted in a manner simulating their actual installation. In the case of fluid fittings, lines or conduits should be connected to both sides of the fittings to simulate actual conditions of heat conduction that would be present during an actual fire in the aircraft. The test should be conducted with the operating fluid in the lines unless the design and function of the system is such as to preclude the presence of the fluid in the lines during an actual fire in the aircraft.

Fire-Resistant Materials

The following test is considered acceptable for demonstrating compliance with §§ 25.853, 25.857, 27.855, 29.853 and 29.855 (CAR §§ 4b.381, 4b.383, 6.382, 7.38l, and 7.382).

If the material is rigid, an eight-inch specimen should be tested. If the material is flexible, the material should be placed in a frame exposing an area of eight inches by eight inches. If a backing will be used in the airplane, the test specimen should be provided with the same backing.

The test specimen should be supported at an angle of 45 degrees to a horizontal surface. The surface that will be exposed, when installed in the aircraft, should face down for the test. The specimen should be exposed to either a Bunsen or a Tirrill burner adjusted for no air intake, giving a yellow-tipped l-l/2 inch flame when resting on a horizontal surface. Suitable precautions should be taken to avoid drafts. The period of flame application should be 30 seconds with one-third of the flame in contact with the material at the center of the specimen.

To be acceptable, no penetration of the material should result during application of the test flame or subsequent to its removal, and if the material ignites, the

flame should extinguish itself within l5 seconds with no smoldering or glowing visible l0 seconds thereafter.

Flame Resistant Material

The following test is considered acceptable for demonstrating compliance with §§ 23.853, 25.853, 25.855, 27.853, 27.855 and 29.853 (CAR §§ 3.388(a), 4b.38l, 4b.382, 6.38l, 6.382, and 7.38l).

Test specimens. Three specimens, approximately four inches wide and l4 inches long, should be tested. Each specimen should be clamped in a metal frame so that the two long edges and one end are held securely. The frame should be such that the exposed area of the specimen is at least two inches wide and l3 inches long, with the free end at least l/2-inch from the end of frame for ignition purposes. In the case of fabrics, the direction of the weave corresponding to the most critical burn rate should be parallel to the l4-inch dimension. A minimum of l0 inches of the specimen should be used for timing purposes and approximately l-l/2 inches should burn before the burning front reaches the timing zone. The specimen should be long enough so that the timing is stopped at least one inch before the burning front reaches the end of the exposed specimen.

Test procedure. The specimens should be supported horizontally and tested in draft-free conditions. The surface that will be exposed when installed in the aircraft, should face down for the test. The specimens should be ignited by a Bunsen or Tirrill burner. To be acceptable, the average burn rate of the three specimens must not exceed four inches per minute. Alternatively, if the specimens do not support combustion after the ignition flame is applied for l5 seconds, or if the flame extinguishes itself and subsequent burning without a flame does not extend into the undamaged areas, the material is also acceptable. (Federal Specification CCC-T-191b, Method 5906, may also be used for testing materials of this type, but the material should not exceed the above four inches per minute burn rate.)

Flash-Resistant Materials

The following test is considered acceptable for demonstrating compliance with §§ 23.853, 25.853, 27.853 and 29.853 (CAR §§ 3.388(a), 4b.38l, 6.38l, and 7.38l).

Test specimens. Three specimens, approximately 4 inches wide by l4 inches long, should be tested. Each specimen should be clamped in a metal frame so that the two long edges and one end are held securely. The frame should be such that the exposed area of the specimen is at least two inches wide and l3 inches long, with the free end at least l/2 inch from the end of the frame for ignition purposes. In the case of fabrics, the direction of the weave corresponding to the most critical burn rate should be parallel to the l4-inch dimension. A minimum of l0 inches of the specimen should be used for timing

purposes, and approximately l-l/2 inches should burn before the burning front reaches the timing zone. The timing should be stopped at least one inch before the burning front reaches the end of the exposed specimen.

Test procedure. Each of the three specimens should be supported horizontally and tested in draft-free conditions. The surface that will be exposed, when installed in the aircraft, should face down for the test. The specimens may be ignited by a match or similar means. If the specimens do not support combustion after the ignition flame is applied for l5 seconds, or if the average burn rate of the three specimens does not exceed 20 inches per minute, the material is acceptable. (Federal Specification CCC-T-l9lb, Method 5906, may also be used for testing materials of this type but the material should not exceed the above 20 inches per minute burn rate.)

(3) Paragraph (a) and (b). The use of fire/flame retardants is acceptable. The type data should specify the retardant and process for treatment. Treatment should be applied prior to conditioning. The effects of aging and environmental conditions should be considered in the use of retardants. If aging, dry cleaning, washing, etc., adversely affect retardant properties, appropriate documents such as the maintenance manual should address this issue.

(4) Oxygen lines for certification basis through Amendment 25-3l and oxygen masks should meet flame resistant criteria. Systems are to be tested in their normal state (which includes lines filled with oxygen, if that is the case; see paragraph 625b(3) of this AC). Oxygen distribution systems, normally pressurized, are aluminum for low pressure (500 psi or less) and stainless steel for high pressure (above 500 psi). Aluminum is classed as "fire resistant" and stainless steel as "fireproof" in the Code of Federal Regulations (CFR) 14, part 1, § l.l. These materials are normally not tested to § 25.853 due to their definition, although the authority of that regulation does allow it.

(5) Paragraph (c). Self-contained is defined as a receptacle within a receptacle, one of which has a lid. Both receptacles are considered trash containers and should meet fire-resistant criteria as defined in CFR 14, part 1, § l.l and in the preceding guidance in paragraph 621b(2) of this AC. The fixed receptacle should be sealed to prevent penetration of fire or residue into the surrounding area. Ashtrays installed in movable or removable armrests which will spill their contents when the armrest is moved or raised, as in the case of hinged armrests, are not considered self-contained.

(6) Paragraph (c).

(i) In order to avoid confusion in compartments where it is intended that smoking is not to be permitted, and No Smoking placards are installed, the lighted No Smoking signs should either be disabled or, preferably, hardwired ON.

(ii) Hardwired ON lighted No Smoking signs have been considered to be equivalent, and even preferred, alternatives to required No Smoking placards in compartments where smoking is not to be permitted.

(iii) In divided compartments where smoking is permitted in one compartment but not in an adjacent one, especially where the no-smoking compartment is aft of the smoking compartment, care needs to be exercised in the placement and design of placarding and/or No Smoking lighted signs to assure no confusion exists. The smoking compartment should be controlled by lighted No Smoking signs controlled by the crew. Passengers in the no-smoking compartment should not be able to see the lighted No Smoking signs in the smoking compartment being switched off. All lighted No Smoking signs visible to passengers in the no-smoking compartment should be hard-wired ON. No Smoking placards may also be installed in the no-smoking compartment, but they are considered insufficient, by themselves, to override the confusing effect of switchable No Smoking signs being visible to them.

(7) Paragraph (d). Waste receptacles may be mounted in the airplane structure or may be portable units such as food or waste carts. Appendix 8 contains methodology for substantiating compliance with fire containment criteria.

(8) Paragraph (e) and (f). See AC 20-42C, "Hand Fire Extinguishers for use in Aircraft," for guidance on acceptable fire extinguishers.

622. AMENDMENT 25-l5, Effective October 24, 1967.

a. Change to Regulation.

Materials (including finishes, if applied) used in each compartment occupied by the crew or passengers, must meet the following test criteria, as applicable:

(a) When tested in accordance with the applicable portions of Appendix F of this part or the applicable portions of methods 5902 and 5906 dated May l5, l95l, of Federal Specification CCC-T-l9lb (which is available from the General Services Administration, Business Service Center, Region 3, Seventh and D Streets S.W., Washington, D.C. 20407), or other approved equivalent method, the interior wall panels, interior ceiling panels, draperies, structural flooring, baggage racks, partitions, thermal insulation, and coated fabric insulation covering must be self-extinguishing after flame removal. All materials used in these applications must be tested vertically. If the material is tested vertically as a fabricated unit, a section of that fabricated unit must also be tested horizontally. The average char length may not exceed 8 inches when the material is tested vertically, and may not exceed 4 inches when the material is tested horizontally. Layered materials may not be separated for the purpose of this test.

(b) When tested horizontally under the applicable portions of Appendix F of this part, or the applicable portions of method 5906, dated May l5, l95l of Federal Specification CCC-T-l9lb, or other approved equivalent method, interior materials not specified in paragraph (a) of this section must be at least flame resistant. Layered materials may not be separated for the purpose of this test.

b. Guidance.

(1) Paragraph (a). A "fabricated unit" specimen is one in which the actual panel edge is exposed to the test flame. The panel edge may be a metal extrusion and, therefore, the panel materials would be protected from the test flame. In this case, additional "section" specimens must be cut from the panel so that the specimen does not include the edge protection, and, tested horizontally. The "section" horizontal test need not be conducted if (1) the panel edge is equally or more flammable than a section edge and the "fabricated unit" specimens pass the vertical test with the panel edge exposed to the test flame, or (2) the panel edge is less flammable than a "section" specimen edge but the "section" specimens pass the vertical test.

(2) Paragraphs (a) and (b). Appendix F, effective October 24, 1967, is applicable to § 25.853, Amendment 25-15 through Amendment 25-3l; and § 121.312. See Appendix F beginning at paragraph 1151.

(3) Paragraphs (a) and (b). Layered materials are entities formed by combining two or more separate materials by bonding, mechanically fastening or other means such that the resulting unit cannot be easily disassembled. Disassembly by removal of screws, staples, glue joints, etc., would not be considered easy.

(4) Paragraphs (a) and (b). Velcro type material should be tested with the velcro material attached to its backing material but not hook to pile.

(5) Paragraphs (a) and (b). If a material is demonstrated to comply with paragraph (a), it is also considered to comply with paragraph (b). The reverse is not true.

623. AMENDMENT 25-l7, Effective June 20, 1968.

a. Change to Regulation.

Materials (including finishes, if applied) used in each compartment occupied by the crew or passengers (other than materials such as wire insulation, conduit, plastic material in "black boxes," rub strips, pulleys, and small nonmetallic materials that are located behind interior walls or above interior ceilings) must meet the following test criteria, as applicable:

(a) Except as provided in paragraph (b) of this section, interior wall panels, interior ceiling panels, draperies, structural flooring, baggage racks, partitions (including wind screens), thermal insulation, light cover transparencies in panel form, and coated fabric insulation covering must be self-extinguishing after flame removal when tested in accordance with the applicable portions of Appendix F of this part or the applicable portions of Methods 5902 and 5906, dated May l5, l95l, or Federal Specification CCC-T-l9lb (which is available from the General Services Administration, Business Service Center, Region 3, Seventh and D Streets Southwest, Washington, D.C. 20407), or other approved equivalent method. All materials used in these applications must be tested vertically. If the material is tested vertically as a fabricated unit, a section of that fabricated unit must also be tested horizontally. The average char length may not exceed 8 inches when the material is tested vertically, and may not exceed 4 inches when the material is

tested horizontally. Layered materials may not be separated for the purpose of this test.

(b) Thermoplastic window frames, clip-in trim strips, light reflectors, speaker cones, decompression grills, window transparencies, light cover transparencies not in panel form, ducting, edge-lighted instrument panels made from MIL-P-5425C finish sheet A or from L-P-380a, Type II, Class 3 methacrylate molding plastic, and any other interior materials not specified in paragraph (a) of this section must be at least flame resistant when tested horizontally under the applicable portions of Appendix F of this part, or the applicable portions of Method 5906, dated May 15, 1951, of Federal Specification CCC-T-191b, or other approved equivalent method. Layered materials may not be separated for the purpose of this test.

b. Guidance.

(l) Lead-in paragraph. Material in "black boxes" which are completely self-contained by self-extinguishing material need not be tested. If parts are not completely self-contained or ventilation is provided, then appropriate flammability tests should be conducted. See AC 25-10, "Guidance for Installation of Miscellaneous, Nonrequired Electrical Equipment."

(2) Paragraphs (a) and (b). Sections 25.853 and 25.855 apply to occupied, baggage, and cargo compartments. However, insulation and ducts that are used for occupied, baggage, and cargo compartments are considered part of those compartments, even though items may be located in an adjacent electronics or equipment bay. Therefore, the insulation should meet § 25.853(a) and the ducts should meet § 25.853(b).

(3) Paragraphs (a) and (b). Appendix F, effective October 24, 1967, applies. See Appendix F beginning at paragraph 1151.

624. AMENDMENT 25-23, Effective May 8, 1970.

a. Change to Regulation.

(e) There must be at least one hand fire extinguisher conveniently located in the pilot compartment.

b. Guidance. There is no additional guidance for this amendment.

625. AMENDMENT 25-32, Effective May 1, 1972.

a. Change to Regulation.

Materials (including finishes or decorative surfaces applied to the materials) used in each compartment occupied by the crew or passengers must meet the following test criteria as applicable:

(a) Interior ceiling panels, interior wall panels, partitions, galley structure, large cabinet walls, structural flooring, and materials used in the construction of stowage compartments (other than underseat stowage compartments and compartments for stowing small items such as magazines and maps) must be self-extinguishing when tested vertically in accordance with the applicable portions of Appendix F of this part, or other approved equivalent methods. The average burn length may not exceed six inches and the average flame time after removal of the flame source may not exceed 15 seconds. Drippings from the test specimen may not continue to flame for more than an average of three seconds after falling.

(b) Floor covering, textiles (including draperies and upholstery), seat cushions, padding, decorative and non-decorative coated fabrics, leather, trays and galley furnishings, electrical conduit, thermal and acoustical insulation and insulation covering, air ducting, joint and edge covering, cargo compartment liners, insulation blankets, cargo covers, and transparencies, molded and thermoformed parts, air ducting joints, and trim strips (decorative and chafing), that are constructed of materials not covered in paragraph (b-2) of this section must be self extinguishing when tested vertically in accordance with the applicable portions of Appendix F of this part, or other approved equivalent methods. The average burn length may not exceed 8 inches and the average flame time after removal of the flame source may not exceed 15 seconds. Drippings from the test specimen may not continue to flame for more than an average of 5 seconds after falling.

(b-l) Motion picture film must be safety film meeting the Standard Specifications for Safety Photographic Film PH 1.25 (available from the United States of America Standards Institute, 10 East 40th Street, New York, N.Y. 10018), or an FAA-approved equivalent. If the film travels through ducts, the ducts must meet the requirements of paragraph (b) of this section.

(b-2) Acrylic windows and signs, parts constructed in whole or in part of elastomeric materials, edge lighted instrument assemblies consisting of two or more instruments in a common housing, seat belts, shoulder harnesses, and cargo and baggage tiedown equipment, including containers, bins, pallets, etc., used in passenger or crew compartments, may not have an average burn rate greater than 2-1/2 inches per minute when tested horizontally in accordance with the applicable portions of Appendix F of this part, or other approved equivalent methods.

(b-3) Except for electrical wire and cable insulation, and for small parts (such as knobs, handles, rollers, fasteners, clips, grommets, rub strips, pulleys, and small electrical parts) that the Administrator finds would not contribute significantly to the propagation of a fire, materials in items not specified in paragraphs (a), (b), (b-l), or (b-2) of this section may not have a burn rate greater than 4.0 inches per minute when tested horizontally in accordance with the applicable portions of Appendix F of this part or other approved equivalent methods.

b. Guidance.

(l) Paragraph (a). Carpets which extend up and become part of a vertical panel should also meet § 25.853(a).

(2) Paragraph (b). Carpets may be tested without serging.

(3) Paragraph (b). Oxygen lines are considered ducted systems and should be tested in their normal state: pressurized to the maximum operating pressure with a gas considered safe for testing. See paragraph 621.b.(4) above.

(4) Paragraph (b). As required by Appendix F, foam shall be tested in 1/2-inch thicknesses. If the cushion consists of two or more foams glued together, the foam specimens should be two 1/4-inch (three 1/6-inch, etc.) pieces glued together. Three specimens should be made for each combination of foams that are glued together in the production cushion. Any other production cushion components that are glued together, should be tested together. If such specimens do not pass, it is acceptable to test each production cushion component separately, including a sheet of glue. Additionally, the Bunsen burner is then applied to three separate corners of the production cushion with all its components. The cushion is satisfactory if all tests meet the test criteria. The three corner tests need not be conducted, if the cushion passes the tests of part II or Appendix F.

(5) Paragraph (b-3). Blankets, pillows, headrest covers, and carry-on items that are not part of the aircraft type design are not required to meet the flammability standards.

(6) Paragraph (b-3). Relative to lavatory smoke detectors, the following is quoted from the preamble to Amendment 121-185, effective April 29, 1985: "Unless some circumstance or design feature unforeseen at this time requires otherwise, materials used in the construction of relatively small commercially available smoke detectors would not contribute significantly to the propagation of a fire and would be covered by the small parts exclusion of § 25.853(b-3)."

(7) Paragraphs (a) through (b-3). Appendix F, effective May 1, 1972, applies. See Appendix F beginning at paragraph 1151.

(8) Paragraphs (a) through (b-3). See AC 25-10, "Guidance for Installation of Miscellaneous, Nonrequired Electrical Equipment."

(9) Paragraphs (b), (b-2), and (b-3). If material is demonstrated to comply with paragraph (b), it is also considered to comply with paragraphs (b-2) and (b-3). The reverse is not true.

(10) Paragraph (d). To meet the "fire resistant" requirements, the receptacle construction should meet the 45-degree burn test described in § 25.855(a-1).

(11) Paragraphs (d),(e) and (f) of Appendix F. For measuring the flame temperature of 1550° F, the center of the flame is 3/4-inch above the top edge of the burner.

626. AMENDMENT 25-51, Effective March 6, 1980.

a. Change to Regulation.

(c) If smoking is to be prohibited, there must be a placard so stating, and if smoking is to be allowed--

(l) There must be an adequate number of self-contained, removable ashtrays; and

(2) Where the crew compartment is separated from the passenger compartment, there must be at least one sign meeting the "No Smoking" sign requirements of § 25.791 notifying all passengers when smoking is prohibited.

(d) Each disposal receptacle for towels, paper, or waste must be fully enclosed and constructed of at least fire resistant materials, and must contain fires likely to occur in it under normal use. The ability of the disposal receptacle to contain those fires under all probable conditions of wear, misalignment, and ventilation expected in service must be demonstrated by test. A placard containing the legible words "No Cigarette Disposal" must be located on or near each disposal receptacle door.

(e) Lavatories must have "No Smoking" or "No Smoking in Lavatory" placards located conspicuously on each side of the entry door, and self-contained removable ashtrays located conspicuously on or near the entry side of each lavatory door, except that one ashtray may serve more than one lavatory door if the ashtray can be seen readily from the cabin side of each lavatory door served. The placards must have red letters at least one-half inch high on a white background of at least one inch high. (A "No Smoking" symbol may be included on the placard.)

b. Guidance.

(1) This amendment deleted §§ 25.853(e) and (f). These requirements were moved to §§ 25.851(a)(5) and (6) per Amendment 25-54. This change was a consolidation of regulations for hand fire extinguishers.

(2) Paragraph (e). These requirements reflect those of AD 74-08-09, effective April 30, 1974.

627. AMENDMENT 25-59, Effective November 26, 1984.

a. Change to Regulation.

(c) In addition to meeting the requirements of paragraph (b), seat cushions, except those on flight crewmember seats, must meet the test requirements of part II of Appendix F of this part, or equivalent.

This change replaced the existing paragraph (c) with a new paragraph (c) and relettered existing paragraphs (c) through (e) as (d) through (f).

b. Guidance. See AC 25.853-1, "Flammability Requirements for Aircraft Seat Cushions."

628. AMENDMENT 25-60, Effective June 16, 1986.

a. Change to Regulation.

(b) Floor covering, textiles (including draperies and upholstery), seat cushions, padding, decorative and nondecorative coated fabrics, leather, trays and galley furnishings, electrical conduit, thermal and acoustical insulation covering, air ducting, joint and edge covering, liners of Class B and E cargo or baggage compartments, floor panels of Class C or D cargo and baggage compartments, insulation blankets, cargo covers, and transparencies, molded and thermoformed parts, air ducting joints, and trim strips (decorative and chafing), that are constructed of materials not covered in paragraph (b-2) of this section, must be self-extinguishing when tested vertically in accordance with the applicable portion of Part 1 of Appendix F of this part, or other approved equivalent methods. The average burn length may not exceed 8 inches, and the average flame time after removal of the flame source may not exceed 15 seconds. Drippings from the test specimen may not continue to flame for more than an average of 5 seconds after falling.

b. Guidance. There is no additional guidance for this amendment

629. AMENDMENT 25-61, Effective August 20, 1986.

a. Change to Regulation.

(a-1) For airplanes with passenger capacity of 20 or more, interior ceiling and wall panels (other than lighting lenses), partitions, and the outer surfaces of galleys, large cabinets and stowage compartments (other than underseat stowage compartments and compartments for stowing small items, such as magazines and maps) must also meet the test requirements of Part IV of Appendix F of this part, or other approved equivalent method, in addition to the flammability requirements prescribed in paragraph (a) of this section.

b. Guidance. There is no additional guidance for this amendment

630. AMENDMENT 25-66, Effective September 26, 1988.

a. Change to Regulation.

(a-1) For airplanes with passenger capacity of 20 or more, interior ceiling and wall panels (other than lighting lenses), partitions, and the outer surfaces of galleys, large cabinets, and stowage compartments (other than underseat stowage

compartments and compartments for stowing small items, such as magazines and maps) must also meet the test requirements of Parts IV and V of Appendix F of this part, or other approved equivalent method, in addition to the flammability requirements prescribed in paragraph (a) of this section.

b. Guidance. Paragraph (a-1) Some first or business class seats incorporate large panel assemblies, either in the form of consoles, or hard shells, or both. From the standpoint of surface area, each seat/console assembly constitutes a significant amount of material, on the order of a galley or closet. All components that make up an affected part (for example, several small panels that make up a large ceiling panel) are required to comply with the standard applicable to the larger part. Therefore, the outer shell of the seat itself, including panel assemblies of consoles, is required to comply with Appendix F, Parts IV and IV, of Part 25.

631-650. [RESERVED]

SECTION 25.855 CARGO AND BAGGAGE COMPARTMENTS

651. REGULATION IN EFFECT AT ADOPTION OF PART 25.

a. Regulation.

(a) Each cargo and baggage compartment (including tie-down equipment) must be constructed of materials that are at least flame resistant.

(b) No compartment may contain any controls, wiring, lines, equipment, or accessories whose damage or failure would affect safe operation, unless those items are protected so that--

(1) They cannot be damaged by the movement of cargo in the compartment; and

(2) Their breakage or failure will not create a fire hazard.

(c) There must be means to prevent cargo or baggage from interfering with the functioning of the fire-protective features of the compartment.

(d) Sources of heat within the compartment must be shielded and insulated to prevent igniting the cargo.

(e) Cargo compartments must meet one of the class requirements of § 25.857. In addition, flight tests must be conducted to show compliance with the provisions of § 25.857 concerning--

(1) Compartment accessibility;

(2) The entry of hazardous quantities of smoke or extinguishing agent into compartments occupied by the crew or passengers; and

(3) The dissipation of the extinguishing agent in Class C compartments.

During these tests, it must be shown that no inadvertent operation of smoke or fire detectors in any compartment would occur as a result of fire contained in any one compartment, either during or after extinguishment, unless the extinguishing system floods each such compartment simultaneously.

b. Guidance. Paragraph (a). See paragraph 621b(2) for an acceptable test for flame resistance.

652. AMENDMENT 25-15, Effective October 24, 1967.

a. Change to Regulation.

(a) Each cargo and baggage compartment (including tie-down equipment) must be constructed of materials that at least meet the requirements set forth in § 25.853.

b. Guidance. This change required that the materials used in the cargo and baggage compartments at least meet the requirements of § 25.853(a) or (b), depending on the application of the material (which were also changed by this amendment). The standards in amended § 25.853(a) and (b) were believed to represent the most advanced technology then available in the design area.

653. Amendment 25-32, Effective May 1, 1972.

a. Change to Regulation.

(a) Thermal and acoustic insulation (including coverings) and liners, used in each cargo and baggage compartment not occupied by passengers or crew, must be constructed of materials that at least meet the requirements set forth in § 25.853(b).

(a-1) Class B through Class E cargo or baggage compartments, as defined in § 25.857, must have a liner and the liner must be constructed of materials that at least meet the requirements set forth in § 25.853(b), must be separate from (but may be attached to) the airplane structure, and must be tested at a 45-degree angle in accordance with the applicable portions of Appendix F of this part or other approved equivalent methods. In the course of the 45-degree angle test, the flame may not penetrate (pass through) the material during application of the flame or subsequent to its removal, the average flame time after removal of the flame source may not exceed 15 seconds, and the average glow time may not exceed 10 seconds.

(a-2) Insulation blankets and cargo covers used to protect cargo in compartments not occupied by passengers or crew must be constructed of materials that at least meet the requirements of § 25.853(b), and tie-down equipment (including containers, bins, and pallets) used in each cargo and baggage compartment not occupied by passengers or crew must be constructed of materials that at least meet the requirements set forth in § 25.853(b-3).

b. Guidance.

(1) The purpose of this change was to delete the requirement for a liner in cargo compartments from § 25.857 and put it in § 25.855 and identify the requirement appropriate to Class B through E cargo and baggage compartments. Liner flame penetration for the 45-degree angle test of Appendix F was also emphasized. Also, an additional flammability test in accordance with § 25.853(b) was required for the liner. In paragraph (a-2), the reference to § 25.853(b-3) should be (b-2). See § 25.853(b-2).

(2) See AC 25-9, "Smoke Detection, Penetration, and Evacuation Test, and Related Flight Manual Procedure."

654. AMENDMENT 25-60, Effective June 16, 1986

a. Regulation.

(a-1) Class B through Class E cargo or baggage compartments, as defined in § 25.857, must have a liner and the liner must be separate from (but may be attached to) the airplane structure, and must be tested as follows:

(1) Ceiling and sidewall liner panels of Class C and D compartments must meet the test requirements of Part III of Appendix F of this part or other approved equivalent methods.

(2) Floor panels of all compartments and ceiling and sidewall liner panels of Class B and E compartments must be constructed of materials that meet at least the requirements set forth in § 25.853(b). Also, these liner panels must be tested at a 45-degree angle in accordance with the applicable portions of Part I of Appendix F of this part or other approved equivalent methods. The flame may not penetrate (pass through) the material during application of the flame or subsequent to its removal. The average flame time after removal of the flame source may not exceed 15 seconds, and the average glow may not exceed 10 seconds.

b. Guidance.

(1) Paragraph (a-1)(1). Material constructions (panels) which meet the ceiling liner test requirements are also acceptable for use as sidewall panels. The converse is not true.

(2) Paragraph (a-1)(1). The following is recommended when testing design features found in ceiling or sidewall panels:

(i) When testing joints and seams, position them longitudinally in the ceiling sample holder centered over the burner cone. If the seam or joint is in the sidewall, test it in the longitudinal position of the sidewall sample holder 2 inches below the sidewall top. All fastening systems should be tested similarly.

(ii) When testing corners, the corner should be positioned in the test fixture as it normally is in service. The test fixture may be altered slightly to accommodate this design feature. This will require the removal of the angle iron on the back corner of the fixture.

(iii) When testing lighting fixtures or pressure-relief valves, any material forming the fire barrier should be tested as a flat sheet in the ceiling or sidewall position (depending on actual location in the cargo compartment) and treated as a liner.

(3) Paragraph (a-1)(2). Holes in ceiling panels used to provide access for smoke detector sampling ports should not be larger than 3/8-inch in diameter.

655 - 670. [RESERVED]

SECTION 25.857 CARGO COMPARTMENT CLASSIFICATION

671. REGULATION IN EFFECT AT ADOPTION OF PART 25.

a. Regulation.

(a) Class A. A Class A cargo or baggage compartment is one in which--

(1) The presence of a fire would be easily discovered by a crewmember while at his station; and

(2) Each part of the compartment is easily accessible in flight.

(b) Class B. A Class B cargo or baggage compartment is one in which--

(1) There is sufficient access in flight to enable a crewmember to effectively reach any part of the compartment with the contents of a hand fire extinguisher;

(2) When the access provisions are being used, no hazardous quantity of smoke, flames or extinguishing agent, will enter any compartment occupied by the crew or passengers;

(3) There is a separate approved smoke detector or fire detector system to give warning at the pilot or flight engineer station; and

(4) There is a fire-resistant lining.

(c) Class C. A Class C cargo or baggage compartment is one not meeting the requirements for either a Class A or B compartment but in which--

(1) There is a separate approved smoke detector or fire detector system to give warning at the pilot or flight engineer station;

(2) There is an approved built-in fire-extinguishing system controllable from the pilot or flight engineer stations;

(3) There are means to exclude hazardous quantities of smoke, flames, or extinguishing agent, from any compartment occupied by the crew or passengers;

(4) There are means to control ventilation and drafts within the compartment so that the extinguishing agent used can control any fire that may start within the compartment; and

(5) There is a fire-resistant lining.

(d) Class D. A Class D cargo or baggage compartment is one in which--

(1) A fire occurring in it will be completely confined without endangering the safety of the airplane or the occupants;

(2) There are means to exclude hazardous quantities of smoke, flames, or other noxious gases, from any compartment occupied by the crew or passengers;

(3) Ventilation and drafts are controlled within each compartment so that any fire likely to occur in the compartment will not progress beyond safe limits;

(4) There is a fire-resistant lining; and

(5) Consideration is given to the effect of heat within the compartment on adjacent critical parts of the airplane.

For compartments of 500 cubic feet or less, an airflow of 1500 cubic feet per hour is acceptable.

(e) Class E. A Class E cargo compartment is one on airplanes used only for the carriage of cargo and in which--

(1) There is a fire-resistant lining;

(2) There is a separate approved smoke or fire detector system to give warning at the pilot or flight engineer station;

(3) There are means to shut off the ventilating airflow to, or within, the compartment, and the controls for these means are accessible to the flightcrew in the crew compartment;

(4) There are means to exclude hazardous quantities of smoke, flames, or noxious gases, from the flightcrew compartment; and

(5) The required crew emergency exits are accessible under any cargo loading condition.

b. Guidance.

(1) In the interest of fire protection, classification of cargo compartments on transport category airplanes was developed and incorporated into a rule with CAR Amendment 04-1 on November 1, 1946. Class A, B, and C categories were established, and two basic factors of fire protection were envisioned:

(i) Detection of a fire by a crewmember while at his station.

(ii) Extinguishment or suppression of the fire when detected.

(2) Later, a Class D compartment was developed and incorporated into a rule with CAR Amendment 4b-6 on July 20, 1950. Further, when a need developed for bulk loading cargo into the main cabin in which the fire protection provision of the Class A, B, C, and D did not suffice, a Class E category was established. The Class E was incorporated into a rule with CAR Amendment 4b-10 on April 23, 1959. The basic category provisions are essentially the same to date in current Part 25 requirements. The main differences in classification are:

(i) Accessibility.

(ii) Means of detection of fire or smoke.

(iii) Method of extinguishment or suppression of fire.

(iv) Protection for structural members.

(3) As prescribed in CAR 4b and Part 25, the Class A requires that the presence of a fire be readily discernible to a crewmember at his station and that all parts be easily accessible. The Class B must also be accessible, but detection is by smoke/fire detectors. The Class C, D, and E are generally not accessible and detection in the C and E are by smoke/fire detectors. Extinguishment in the Class C is by flooding, in the Class D by suppressing oxygen, and in the Class E by shutting off the ventilating airflow. Fire resistant liners were required in the Class B, C, D, and E for protection of structural members.

(4) With the exception of the Class D, which is limited to 2000 cubic feet, and the Class E, which was designed to encompass the entire passenger cabin, no specific volume limits were prescribed for the other category compartments. Early regional guidance, however, envisioned the Class A compartment as a small open container for storage of crew luggage located in the pilot compartment where the presence of any fire could be rapidly detected by the crew. See the guidance in paragraph 672.b.(2) below.

(5) Paragraph (b)(1) In order to demonstrate that any part of the compartment can be effectively reached, the following test may be conducted:

(i) The test may be conducted in an airplane sitting statically on the ground. The cargo compartment should be filled to that allowed by the type design with empty cardboard boxes and such as mail bags filled with crumpled newspapers.

(ii) The assigned flight crewmember should be seated at his station with his seat belt and shoulder harness engaged.

(iii) When the test begins, the crewmember should don the portable oxygen equipment, carry the fire extinguisher to the most remote part of the cargo compartment and remove the necessary boxes and bags in order to touch the pre-assigned and/or identified most remote box or bag with his hand. This ends the test.

(iv) The test time should be no longer than 5 minutes.

(6) Paragraphs (b)(3), (c)(1) and (e)(2). An acceptable detection time for smoke detectors is 5 minutes. Use the smoke quantity and location criteria of AC 25-9, "Smoke Detection, Penetration, and Evacuation Tests, and Related Flight Manual Emergency Procedures," for showing that the smoke detection system detects a fire in satisfactory time. The time for fire detection systems was changed to one minute by Amendment 25-54 in § 25.858.

(7) Paragraphs (b)(4), (c)(5), (d)(4), and (e)(1). See paragraph 621b(2) for an acceptable test for fire resistance.

(8) See AC 25-9, "Smoke Detection, Penetration, and Evacuation Test, and Related Flight Manual Emergency Procedures."

(9) The lining discussed in the Class B, C, D, and E, compartments refers to the sidewalls, ceilings and forward and aft panels of the compartments.

672. AMENDMENT 25-32, Effective May 1, 1972.

a. Change to Regulation. The purpose of this amendment was to delete the requirement for a liner in cargo compartments from § 25.857 and put it in § 25.855. This was done for each class cargo compartment from Class B through E and the former entry was reserved.

b. Guidance.

(1) There is no guidance for this change in regulation. When the liner requirements were transferred to § 25.855, in addition to being fire resistant, the liner also had to meet the flammability requirements of § 25.853(b).

(2) Guidance material was developed to assure that approvals of cargo compartments would meet the intent of the rule and DOT/FAA Order 8110.27A, CAR 4b.383 and FARs 25.855 and 25.857, Cargo Compartment Classification Requirements, was written for that purpose in 1978. The order is pertinent to all certificated airplanes engaged in cargo operations and previous approvals not commensurate with the order will not be accepted as precedent. The following is based on the procedures from that order:

(i) Class A. A compartment in which the presence of a fire would be easily discovered by a crewmember while at his station, all parts of which are easily accessible in flight. This is typically a small compartment used for crew luggage and located in the cockpit where a fire would be readily detected and extinguished by a crewmember. Due to the small size and location of the compartment, and the relatively brief time required to extinguish a fire, a liner is not needed to protect adjacent structure.

(ii) Class B. A compartment with sufficient access in flight to enable a crewmember to effectively reach any part of the compartment with the contents of a hand fire extinguisher and that incorporates a separate, approved smoke or fire detection system to give warning at the pilot or flight engineer station. A Class B compartment is typically much larger than a Class A compartment and can be located in an area remote from the cockpit. Because of the larger size of the compartment and the greater time interval likely to occur before a fire would be controlled, a

liner meeting the flame penetration standards of § 25.855 and Appendix F of Part 25 must be provided to protect adjacent structure.

(iii) Class C. As defined at the time of initial classification, any compartment that did not fall into either Class A or B was a Class C compartment. Class C compartments differ from Class B compartments primarily in that built-in extinguishment systems are provided for control of fires in lieu of crewmember accessibility.

(iv) Later, two additional classes were established and defined as follows:

(A) Class D. A compartment in which a fire would be completely contained without endangering the safety of the airplane or the occupants. A Class D compartment is similar to a Class C compartment in that both are typically large and located in areas that are not readily accessible to a crewmember. In lieu of providing fire detection and extinguishment, Class D compartments are designed to control a fire by severely restricting the supply of available oxygen. Because an oxygen deprived fire might continue to smolder for the duration of the flight, the capability of the liner to resist flame penetration is especially important.

(B) Class E. The main cargo compartment of an airplane used only for the carriage of cargo. A fire in a Class E compartment is controlled through crew action to shut off the ventilating air flow. Like that of a Class D compartment, the capability of the liner to resist flame penetration is especially important.

(v) Liner materials must currently meet the same flame penetration standards regardless of the class of compartment in which they are used.

(vi) No specific volume limits were established for the various classes of compartments although, as noted above, Class A compartments were envisioned as small, open compartments located in the cockpit area. In addition, the compartment volume and leakage rate are factors that must be considered in determining compliance with the objective requirements of Part 25 for Class D compartments. It has been the position of the FAA that the sum of the volume of a Class D compartment and the volume of leakage from the compartment experienced in one hour should not exceed 2,000 cubic feet.

(vii) A nonaccessible compartment located below the main cabin could be either a Class C or D compartment. Cabin flooring utilized to protect adjacent structure from fire originating in a cargo or baggage compartment located above the floor cannot also serve as the lining for a compartment located below the floor.

673. AMENDMENT 25-60, Effective June 16, 1986.

a. Change to Regulation.

(d)(6) The compartment volume does not exceed 1,000 cubic feet.

b. Guidance. There is no additional guidance for this amendment.

674 - 750. [RESERVED]

SECTION 25.1307 MISCELLANEOUS

751. REGULATION IN EFFECT AT ADOPTION OF PART 25.

a. Regulation.

The following is required miscellaneous equipment:

(a) An approved seat for each occupant.

(b) An approved safety belt for each occupant.

(c) An adequate source of electrical energy.

(d) Electrical protective devices.

(e) A two way radio communication system.

(f) A radio navigation system.

(g) A windshield wiper, or equivalent, for each pilot station.

(h) An ignition switch for each engine meeting the requirements of § 25.1145(b).

(i) An approved portable fire extinguisher.

b. Guidance. There is no guidance relating to crashworthiness for this regulation.

752. AMENDMENT 25-23, Effective May 8, 1970.

a. Change to Regulation.

The following is required miscellaneous equipment:

(a) A seat and safety belt, for each occupant.

(b) Two or more independent sources of electrical energy.

(c) Electrical protective devices, as prescribed in this part.

(d) Two systems for two-way radio communications, with controls for each accessible from each pilot station, designed and installed so that failure of one system will not preclude operation of the other system. The use of a common antenna system is acceptable if adequate reliability is shown.

(e) Two systems for radio navigation, with controls for each accessible from each pilot station, designed and installed so that failure of one system will not preclude operation of the other system. The use of a common antenna system is acceptable if adequate reliability is shown.

(f) A windshield wiper, or equivalent, for each pilot station.

(g) An ignition switch for each engine.

(h) Portable fire extinguishers as prescribed in § 25.853(e) and (f).

b. Guidance.

(l) While equipment listed in § 25.1307 may be referred to in other sections of Part 25, the listing of such equipment in § 25.1307 is necessary since it is only there that the equipment is required. The other sections generally treat the equipment from the standpoint of performance, reliability and installation.

(2) Regarding duplication of communication and navigation radio equipment, although under parts 91 and 121, there are situations in which an airplane can be operated without two communication and navigation systems, there are always operations in which a transport category airplane would be involved which do require dual systems. Therefore, it is considered necessary to make this a design requirement for all future transport category airplanes.

(3) In order to make it clear that some interconnection or component sharing is permissible if system reliability is not impaired, the regulation now requires that there be two systems for two way radio communication designed and installed so that failure of one system will not preclude operation of the other system.

753. AMENDMENT 25-46, Effective December 1, 1978.

a. Change to Regulation.

(a) A seat for each occupant.

b. Guidance. There is no additional guidance for this amendment.

754. AMENDMENT 25-54, Effective October 14, 1980.

a. Change to Regulation.

(h) Portable fire extinguishers as prescribed in § 25.851(a)(5) and (a)(6).

b. Guidance. There is no additional guidance for this amendment.

755-780. [RESERVED]

SECTION 25.1359 ELECTRICAL SYSTEM FIRE AND SMOKE PROTECTION

781. Section 25.1359(d) Did Not Exist Prior to Amendment 25-32.

[NOTE: Section 25.1359(a),(b), and (c) are not considered to be germane to this AC]

782. AMENDMENT 25-32, Effective May 1, 1972.

a. Regulation.

> (d) Insulation on electrical wire and electrical cable installed in any area of the fuselage must be self-extinguishing when tested at an angle of 60 degrees, in accordance with the applicable portions of Appendix F of this part, or other approved equivalent methods. The average burn length may not exceed 3 inches and the average flame time after removal of the flame source may not exceed 30 seconds. Drippings from the test specimen may not continue to flame for more than an average of 3 seconds after falling.

b. Guidance. Paragraph (d). Wiring qualified to military specifications, which require flammability testing equivalent to that specified by the certification basis, do not have to be retested with an FAA witness. See AC 25-10, "Guidance for Installation of Miscellaneous, Nonrequired Electrical Equipment."

783 - 800. [RESERVED]

SECTION 25.1411 SAFETY EQUIPMENT - GENERAL

801. REGULATION IN EFFECT AT ADOPTION OF PART 25.

a. Regulation.

(a) Accessibility. Required safety equipment to be used by the crew in an emergency, such as automatic life raft releases, must be readily accessible.

(b) Stowage provisions. Stowage provisions for required emergency equipment must be furnished and must--

(1) Be arranged so that the equipment is directly accessible and its location is obvious; and

(2) Protect the safety equipment from inadvertent damage.

(c) Emergency exit descent device. The stowage provisions for the emergency exit descent device required by § 25.807(c)(4) must be at the exits for which they are intended.

(d) Life rafts. The stowage provisions for the life rafts described in § 25.1415 must accommodate enough rafts for the maximum number of occupants for which certification for ditching is requested. Life rafts must be stowed near exits through which the rafts can be launched during an unplanned ditching. Rafts automatically or remotely released outside the airplane must be attached to the airplane by means of the static line prescribed in § 25.1415.

(e) Long-range signaling device. The stowage provisions for the long-range signaling device required by § 25.1415 must be near an exit available during an unplanned ditching.

(f) Life preserver stowage provisions. The stowage provisions for life preservers described in § 25.1415 must accommodate one life preserver for each occupant for which certification for ditching is requested. Each life preserver must be within easy reach of each seated occupant.

(g) Life line stowage provisions. If certification for ditching under § 25.801 is requested, there must be provisions to store life lines. These provisions must--

(1) Allow one life line to be attached to each side of the fuselage; and

(2) Be arranged to allow the life lines to be used to enable the occupants to stay on the wing after ditching.

b. Guidance.

(1) Paragraphs (b)(1) and (2).

(i) Safety equipment should be fastened so that it remains operational and accessible following exposure to the emergency landing loads of § 25.561.

(ii) Stowage compartments for safety equipment which are large enough to accommodate additional items that could damage the equipment should be placarded for "soft article only," or, if the safety equipment could be obscured by soft articles, the compartment should be placarded for stowage of emergency equipment only. (See paragraphs 101b(1), 1041b(5), and 1101b(2).)

(2) Paragraph (d). To the extent possible, life rafts should be distributed such that all exits suitable for launching rafts have rafts stowed near them, i.e., rafts are equally distributed among qualified ditching exits (sills above water). "Near" in this context should be taken to mean as physically nearby the exit as practicable, where its stowed location could be readily determined from the vicinity of the exit, and where a minimum of portaging of the raft would be necessary. Also see § 25.1415.

(3) Paragraph (e). The long range signaling device should not be stowed in the cockpit.

(4) Paragraph (f). For domestic operation when life preservers are not required, the life preserver location placard could be retained provided another approved flotation means is provided and its location placarded.

(5) Paragraph (g).

(i) Life line stowage provisions include any structural modifications necessary to accommodate the use of a life line. Therefore, all airplanes of a particular model certificated for ditching should incorporate lifeline stowage provisions.

(ii) Life line stowage provisions are not required for airplanes which do not have ditching exits that lead evacuees on to the wing.

802. AMENDMENT 25-32, Effective May 1, 1972.

a. Change to Regulation.

(c) Emergency exit descent device. The stowage provisions for the emergency exit descent device required by § 25.809 must be at the exits for which they are intended.

b. Guidance. There is no additional guidance for this amendment.

803. AMENDMENT 25-46, Effective December 1, 1978.

a. Change to Regulation.

(a) Accessibility.

(1) Required safety equipment to be used by the crew in an emergency must be readily accessible.

(2) At least one public address system microphone intended for flight attendant use must be positioned at each floor level exit in a passenger compartment and be readily accessible to a flight attendant seated in any seat adjacent to that exit.

(d) Life rafts.

(1) The stowage provisions for the life rafts described in § 25.1415 must accommodate enough rafts for the maximum number of occupants for which certification for ditching is requested.

(2) Life rafts must be stowed near exits through which the rafts can be launched during an unplanned ditching.

(3) Rafts automatically or remotely released outside the airplane must be attached to the airplane by means of the static line prescribed in § 25.1415.

(4) The stowage provisions for each portable life raft must allow rapid detachment and removal of the raft for use at other than the intended exits.

b. Guidance.

(1) Paragraph (a)(2).

(i) The public address system microphone should be accessible to a fifth percentile flight attendant when seated and with seat belt and harness fastened.

(ii) See Paragraph 804 (the amended words to § 25.1411(a)(2)) for the intent of this paragraph.

(2) Paragraph (d)(4). Rapid detachment and removal of life rafts should be demonstrated by test. Two able-bodied adult males directed by a trained crewmember may be used, if the airplane configuration permits use of that many persons.

804. AMENDMENT 25-53, Effective August 31, 1980.

a. Change to Regulation.

(a) Accessibility.

(1) Required safety equipment to be used by the crew in an emergency must be readily accessible.

(2) At least one public address system microphone intended for flight attendant use must be positioned adjacent to a flight attendant seat that is located near each required floor level emergency exit in the passenger compartment and be readily accessible to the seated flight attendant.

b. Guidance. Paragraph (a)(1). Megaphones should be demonstrated to be accessible within five seconds by a fifth percentile flight attendant in the nearest flight attendant seat.

805. AMENDMENT 25-70, Effective November 27, 1989

a. Change to Regulation.

(a) Accessibility requirements.
(2) If a public address system is required by this chapter--
(i) For each required floor-level passenger emergency exit which has an adjacent flight attendant seat, there must be a public address system microphone which is readily accessible to the seated flight attendant, except that--
(ii) One microphone may serve more than one exit, provided the proximity of the exits allows unassisted verbal communication between seated flight attendants.

b. Guidance. Also see § 25.1423 added at this amendment.

806 - 820. [RESERVED]

SECTION 25.1413 SAFETY BELTS

821. REGULATION IN EFFECT AT ADOPTION OF PART 25.

a. Regulation.

(a) If there are means to indicate to the passengers when safety belts should be fastened, they must be installed to be operated from either pilot seat.

(b) The rated strength of safety belts may not be less than that required to withstand the ultimate load factors specified in § 25.561, considering the dimensional characteristics of the belt installation for the specific seat or berth arrangement.

(c) Each belt must be attached so that no part of the anchorage can fail at a load lower than that which would result from the application of ultimate load factors equal to those specified in § 25.561, multiplied by a factor of l.33. This factor must be used instead of the fitting factor prescribed in § 25.625. The forward load factor need not be applied to safety belts for berths.

b. Guidance. There is no guidance for this regulation.

822. AMENDMENT 25-44, Effective December 4, 1978.

a. Change to Regulation.

(d) Each safety belt must be equipped with a metal to metal latching device.

b. Guidance. New § 91.33(b)(12) required that safety belts have metal to metal buckles or latching devices. Implementation of this amendment necessitated corollary amendments to the airworthiness provisions of §§ 23.1413, 25.1413, 27.1413, and 29.1413.

823. AMENDMENT 25-51, Effective March 8, 1980.

a. Change to Regulation.

(c) Each belt and shoulder harness must be attached so that no part of the anchorage can fail at a load lower than that which would result from the application of ultimate load factors equal to those specified in § 25.561, multiplied by a factor of l.33. This factor must be used instead of the fitting factor prescribed in § 25.625. The forward load factor need not be applied to safety belts for berths.

(1) Paragraph (c). The safety belt attachment means should be designed to eliminate or at least minimize the creasing of the seat belt strap.

b. Guidance. There is no additional guidance for this amendment. However, §§ 91.200 and 121.311(e) require that transport category airplanes be equipped with shoulder harnesses at each crewmember seat and flight attendant seat after March 6, 1980. (See paragraphs 81b and 85b for related guidance.)

824 - 840. [RESERVED]

SECTION 25.1415 DITCHING EQUIPMENT

841. REGULATION IN EFFECT AT ADOPTION OF PART 25.

a. Regulation.

(a) Ditching equipment used in airplanes to be certificated for ditching under § 25.801, and operated under the operating rules of this chapter, must meet the requirements of this section.

(b) Each life raft and each life preserver must be approved. In addition--

(l) Unless excess rafts of enough capacity are provided, the buoyancy and seating capacity beyond the rated capacity of the rafts must accommodate all occupants of the airplane in the event of a loss of one raft of the largest rated capacity; and

(2) Each raft must have a trailing line, and must have a static line designed to hold the raft near the airplane but to release it if the airplane becomes totally submerged.

(c) Approved survival equipment must be attached to each life raft.

(d) There must be an approved long-range signaling device for use in one life raft.

(e) For airplanes not certificated for ditching under § 25.801 and not having approved life preservers, there must be an approved flotation means for each occupant. This means must be within easy reach of each seated occupant and must be readily removable from the airplane.

b. Guidance.

(1) Paragraph (b)(1). The determination of life raft requirements in this regard is based on the desired occupancy (crew and passengers), and the normal and overload ratings of the rafts. For a given desired occupancy, all occupants must be accommodated in the rafts without exceeding the normal capacity ratings of all the rafts combined. In addition, for that same desired occupancy, the loss of the largest rated raft is assumed. In that event, the same occupancy must be accommodated in the remaining rafts without exceeding the overload capacity ratings of all the remaining rafts combined. It should be noted that a single raft installation can not comply with this requirement. (2) Paragraph (b)(2). The trailing line is for tying rafts together. The following are quoted from the applicable TSO's. The trailing line is referred to as the heaving-trailing line.

(i) TSO-C12c. Paragraph 4.2.3 HEAVING-TRAILING LINE. At least one floating heaving trailing line not less than 75 feet in length and with a tensile strength of not less than 250 pounds containing a floatable device of suitable size and weight, shall be located on the main

flotation tube(s) near the sea anchor attachment and shall be accessible from either side of the raft.

NOTE: This line is considered as being the trailing line required by CAR 4b.645(a) (Section 25.1415(b)(2) of the FAR).

(ii) TSO-C69a. Paragraph 4.9 HEAVING-TRAILING LINE. At least one floating heaving-trailing line not less than 75 feet in length and at least 250 pounds strength must be located on the main flotation tube near the sea anchor attachment. The attach point of the line must withstand a pull of not less than 1.5 times the line rated strength without damage to the slide/raft.

(iii) TSO-C70a. Paragraph 5.4 HEAVING-TRAILING LINE. At least one floating heaving-trailing line not less than 75 feet in length for Type I rafts and not less than 35 feet in length for Type II rafts, and at least 250 pounds strength, must be located on the main flotation tube near the sea anchor attachment. The attach point of the line must withstand a pull of not less than 1.5 times the line rated strength without damage to the raft. A heaving-trailing line must be accessible in any inflated position of a reversible life raft.

(3) Paragraph (b)(2). The static line is for keeping the life raft or slide/raft near the airplane for boarding after the unit is launched or disconnected from the girt. The following are quoted from the applicable TSO's. The static line is referred to as the mooring line.

(i) TSO-C12c. Paragraph 4.2.1 RAFT MOORING LINE. A suitable mooring line with a wet breaking strength of 450-550 pounds and with a minimum length of 20 feet shall be provided. One end shall be attached to the raft at the point of intersection of the tubes on the outer periphery of the raft with the rest of the line held flaked to the carrying case (See 4.2.8 below). The strength of the attachment of the raft shall be in excess of the strength of the line.

NOTE: This line is considered as being the static line required by CAR 4b.645(a) (Section 25.1415(b)(2) of the FAR).

(ii) TSO-C69a. Paragraph 4.10 MOORING LINE. A nonrotting mooring line at least 20 feet in length must be attached at one end to the slide/raft. The mooring line must be capable of keeping the slide/raft, loaded to maximum rated capacity, attached to a floating aircraft, and not endanger the slide/raft or cause the slide/raft to spill occupants if the aircraft sinks. The line may be equipped with a mechanical release linkage. The breaking strength of the line must be at least 500 pounds, or 40 times the rated capacity of the slide/raft, whichever is greater, but need not exceed 1,000 pounds.

(iii) TSO-C70a. Paragraph 5.10 MOORING LINE. A nonrotting mooring line at least 20 feet in length must be attached at one end to one end of the raft, with the remainder of the line held flaked to the carrying case (See 5.2). The mooring line must be capable of keeping the raft, loaded to maximum rated capacity, attached to a floating aircraft, and not endanger the raft or cause the raft to spill occupants if the aircraft sinks. The line may be equipped with a mechanical release linkage. The breaking strength of the line must be at least 500 pounds, or 40 times the rated capacity of the raft, whichever is greater, but need not exceed 1,000 pounds.

842. AMENDMENT 25-29, Effective October 21, 1971.

a. Change to Regulation.

(d) There must be a survival type emergency locator transmitter that meets the applicable requirements of § 37.200 of this chapter for use in one life raft.

b. Guidance. Paragraph (d). part 37 has been eliminated, therefore the standard the ELT shall meet is TSO-C91A.

843. AMENDMENT 25-52, Effective September 9, 1980.

a. Change to Regulation.

(d) There must be a survival type emergency locator transmitter that meets the applicable requirements of TS0-C91 for use in one life raft.

b. Guidance.

(1) There is no additional guidance for this amendment.

(2) Paragraph (c). See AC 120-47, Survival Equipment for use in Overwater Operations.

844 - 880. [RESERVED]

SECTION 25.1421 MEGAPHONES

881. Section 25.1421 Did Not Exist Prior to Amendment 25-41.

882. AMENDMENT 25-41, Effective September 1, 1977.

a. Regulation.

If a megaphone is installed, a restraining means must be provided that is capable of restraining the megaphone when it is subjected to the ultimate inertia forces specified in § 25.561(b)(3).

b. Guidance. The location of the megaphone and the operation of the restraint means should still allow for quick and easy release of the megaphone.

883 - 920. [RESERVED]

SECTION 25.1423(g) PUBLIC ADDRESS SYSTEMS

908. Section 25.1423 Did Not Exist Prior to Amendment 25-70

909. AMENDMENT 25-70, Effective November 27, 1989.

a. Regulation.

A public address system required by this chapter must--

For each required floor-level passenger emergency exit which has an adjacent flight attendant seat, have a microphone which is readily accessible to the seated flight attendant, except that one microphone may serve more than one exit, provided the proximity of the exits allows unassisted verbal communication between seated flight attendants.

b. Guidance..

(1) "Readily accessible to the seated flight attendant" means that a flight attendant can reach the mike while seated and belted.

(2) Also see § 25.1411(a) and (a)(2) at this amendment level.

910 - 920. [RESERVED]

SECTION 25.1439(a) PROTECTIVE BREATHING EQUIPMENT

921. REGULATION IN EFFECT AT ADOPTION OF PART 25.

a. Regulation.

If there is a Class A, B, or E cargo compartment, protective breathing equipment must be installed for the use of appropriate crewmembers.

b. Guidance. There is no guidance for this regulation.

922. AMENDMENT 25-38, Effective February 1, 1977.

a. Change to Regulation.

If there is a Class A, B, or E cargo compartment, protective breathing equipment must be installed for the use of appropriate crewmembers. In addition, protective breathing equipment must be installed in each isolated separate compartment in the airplane, including upper and lower lobe galleys, in which crewmember occupancy is permitted during flight for the maximum number of crewmembers expected to be in the area during any operation.

b. Guidance. TSO C116, Crewmember Protective Breathing Equipment, provides suitable design standards to meet the intent of this regulation.

923 - 970. [RESERVED]

SECTION 25.1447 EQUIPMENT STANDARDS FOR OXYGEN DISPENSING UNITS

971. REGULATION IN EFFECT AT ADOPTION OF PART 25.

a. Regulation.

If oxygen dispensing units are installed, the following apply:

(a) There must be an individual dispensing unit for each occupant for whom supplemental oxygen is to be supplied. Units must be designed to cover the nose and mouth and must be equipped with a suitable means to retain the unit in position on the face. Flightcrew masks for supplemental oxygen must have provisions for the use of communication equipment.

(b) If certification for operation up to and including 25,000 feet is requested, an oxygen supply terminal and unit of oxygen dispensing equipment for the immediate use of oxygen by each crewmember must be within easy reach of that crewmember. For any other occupants, the supply terminals and dispensing equipment must be located to allow the use of oxygen as required by the operating rules of this chapter.

(c) If certification for operation above 25,000 feet is requested, there must be oxygen dispensing equipment meeting the following requirements:

(1) There must be an oxygen dispensing unit connected to oxygen supply terminals immediately available to each occupant, wherever seated. If certification for operation above 30,000 feet is requested, the dispensing units providing the required oxygen flow rate must be automatically presented to the occupants. The total number of dispensing units and outlets must exceed the number of seats by at least 10 percent. The extra units must be as uniformly distributed throughout the cabin as practicable.

(2) Crewmembers on flight deck duty must be provided with demand equipment. In addition, there must be an oxygen dispensing unit, connected to an oxygen supply terminal, immediately available to each flight crewmember when seated at his station.

(3) There must be at least two outlets and units of dispensing equipment of a type similar to that required by subparagraph (1) of this paragraph in--

(i) Each washroom; and

(ii) Each lavatory, if separate from the washroom.

(4) Portable oxygen equipment must be immediately available for each cabin attendant.

b. Guidance.

(1) Paragraph (c)(1). Automatic presentation is acceptable if the dispensing unit (mask) is presented in front of the eyes when the person's head is resting on the seat back cushion with the seat in any position, such as upright, reclined, swiveled or tracked. The mask need not be presented in front of all persons if there is sufficient "crowd awareness," i.e., the vast majority have proper presentation and the others can readily see that the masks have been presented. These latter persons should have a preflight briefing clearly showing them the location of their mask. The mask should be reachable with the seat belt fastened. In some seating arrangements, such as executive interiors, the various seat positions result in many different combinations of person groupings. Each combination should have an adequate number of masks reachable by every person. Consideration should be given to minimizing the likelihood of persons taking the wrong mask, thus depriving another person of their mask. If the mask must be pulled to initiate oxygen flow, the mask should be presented so that the person must pull the mask to don it. The fifth percentile female and ninety-fifth percentile male should be considered. For such as sleeper seats, bunks or lavatories, a streamer of webbing attached to the mask is acceptable to enable the person to pull the mask down to them.

(2) Paragraph (c)(1). The 10 percent extra mask requirement applies to certification for operation above 25,000 feet and not 30,000 feet as might be thought based on the regulation wording. The reason for these extra masks is stated in the preamble to Amendment 4b-9, effective September 1, 1958, to CAR 4b of 1953. "The cabin attendants, in the course of their normal duties may be at any place in the cabin at the time of depressurization. Since at the normal cruising altitude of turbine-powered airplanes sufficient time may not be available for the attendants to return to a designated oxygen station, it is necessary that either a portable oxygen supply be carried by each attendant or that sufficient additional outlets and units of dispensing equipment be immediately available throughout the cabin to insure that it will be attainable at all times." From a practical standpoint, these extra masks can and will also be used for children seated on an adult's lap.

(3) Paragraph (c)(4). If a portable oxygen bottle is installed for both first aid and cabin attendant use, the bottle must be placarded to clearly indicate the quantity of oxygen intended for each purpose. The placard should also indicate which mask, outlet and/or setting should be used.

(4) Paragraph (c)(4). Portable oxygen bottles intended for flight attendant use need not be installed at a flight attendant station. The bottles should have, to the degree practicable, a uniform distribution in the cabin and be immediately available. There need only be one bottle for each required flight attendant: to comply with § 121.391 or for example, if more flight attendants are used in the evacuation test, the higher number is required. There need not be one bottle for each flight attendant seat.

972. AMENDMENT 25-41, Effective September 1, 1977.

a. Change to Regulation.

(c) If certification for operation above 25,000 feet is requested, there must be oxygen dispensing equipment meeting the following requirements:

(1) There must be an oxygen dispensing unit connected to oxygen supply terminals immediately available to each occupant, wherever seated. If certification for operation above 30,000 feet is requested, the dispensing units providing the required oxygen flow must be automatically presented to the occupants before the cabin pressure altitude exceeds 15,000 feet and the crew must be provided with a manual means to make the dispensing units immediately available in the event of failure of the automatic system. The total number of dispensing units and outlets must exceed the number of seats by at least 10 percent. The extra units must be as uniformly distributed throughout the cabin as practicable.

(2) Each flight crewmember on flight deck duty must be provided with demand equipment. In addition, each flight crewmember must be provided with a quick-donning type of oxygen dispensing unit, connected to an oxygen supply terminal, that is immediately available to him when seated at his station, and that is designed and installed so that it--

(i) Can be placed on the face from its ready position, properly secured, sealed, and supplying oxygen upon demand, with one hand within five seconds and without disturbing eyeglasses or causing delay in proceeding with emergency duties; and

(ii) Allows, while in place, the performance of normal communication functions.

b. Guidance.

(1) Paragraph (c)(1). In order to be assured the dispensing units (masks) are presented before the cabin altitude exceeds 15,000 feet, all system tolerances should be considered. Generally, the aneroid has a broad altitude range of actuation: as much as 2000 feet. It will be acceptable if the upper altitude limit is such as 14,500 feet, thus assuring that the masks will be presented by a cabin altitude of 15,000 feet. This identical guidance has been applied since Amendment 4b-9, effective September 1, 1958, to CAR 4b of 1953. This altitude was associated with the requirements of § 25.841(a) (CAR 4b.374(b)), which requires a cabin altitude of no more than 15,000 feet after a reasonably probable pressurization system failure and § 121.329(c)(3) which requires that 100 percent of the passengers be provided oxygen above a cabin altitude of 15,000 feet.

973 - 1010. [RESERVED]

SECTION 25.1451 FIRE PROTECTION FOR OXYGEN EQUIPMENT

1011. REGULATION IN EFFECT AT ADOPTION OF PART 25.

a. Regulation.

(a) Oxygen equipment and lines may not be in any designated fire zone.

(b) Oxygen equipment and lines must be protected from heat that may be generated in, or escape from, any designated fire zone.

(c) Oxygen equipment and lines must be installed so that escaping oxygen cannot cause ignition of grease, fluid, or vapor accumulations that are present in normal operation or as a result of failure or malfunction of any system.

b. Guidance. Oxygen distribution systems are considered as part of the interior and should meet the applicable standards of § 25.853.

1012 - 1040. [RESERVED]

SECTION 25.1541 MARKINGS AND PLACARDS - GENERAL

1041. REGULATION IN EFFECT AT ADOPTION OF PART 25.

a. Regulation.

(a) The airplane must contain--

(l) The specified markings and placards; and

(2) Any additional information, instrument markings, and placards required for safe operation if there are unusual design, operating, or handling characteristics.

(b) Each marking and placard prescribed in paragraph (a) of this section--

(l) Must be displayed in a conspicuous place; and

(2) May not be easily erased, disfigured, or obscured.

b. Guidance.

(l) Placards indicating emergency equipment should be approximately at eye level and should not blend in with the surrounding decor. A color contrast that complies with § 25.811(f)(2) is acceptable. If the emergency equipment is located in the upper or lower compartment, the eye level placard should have an arrow indicating the compartment. Each compartment containing emergency equipment such as life preservers, rafts, slides, slide/rafts, or fire extinguishers should be placarded as to its contents. For small executive airplanes which may not allow placards to be located at eye level, the placards should be located in as conspicuous a location as practicable.

(2) Placards should be in English and of command type wording. Bilingual placards are acceptable. Required placards and markings not in English do not meet U.S. type design requirements.

(3) Symbolic placards have been approved for certain emergency equipment and passenger information signs. See Appendix 2.

(4) There should be placards on stowage units, overhead bins, dog houses, etc., that state that the doors, drawers, etc., should be latched or secured closed for taxi, take-off and landing.

(5) Unless there is a partition to protect emergency equipment, stowage units that contain emergency equipment should be placarded for soft articles only, no stowage, or emergency equipment only, to preclude damage to the equipment and the possibility of the equipment being hidden by other articles placed in the compartment. (See paragraphs 101b(1), 801b(1)(ii), and 1101b(2).)

(6) Galley and stowage unit doors, drawers, etc., that interfere with the opening of an emergency exit should be spring-loaded closed. The evaluation for interference is made with the stowage unit door in any position and opening the emergency exit from either the inside or the outside. If it is not possible to spring load the door, drawers, etc., there should be a special emphasis placard to close and latch for taxi, takeoff and landing. (See paragraph 411b(2)(vii) and (viii).)

(7) Curtains in aisles and passageways should be placarded to be fastened open for taxi, takeoff and landing. The placards should be visible from both sides of a curtain installed across an aisle and from at least the aisle side of a curtain installed across a passageway to an exit. (See paragraph 412b(3).)

(8) Divided compartments should, for maximum clarity, have each section placarded for its weight limit. (See paragraph 101b(2).) Alternatively, however, a single placard identifying a compartment load limit may be allowed, provided that the placarded load can be distributed among the sections in any manner.

(9) Load limit placards on galleys and stowage units should take into account the critical load distribution.

(10) Appendix 2 contains an illustrated listing of acceptable symbolic regulatory messages.

1042 - 1080. [RESERVED]

SECTION 25.1557(a), (c) and (d) MISCELLANEOUS MARKINGS AND PLACARDS

1061. REGULATION IN EFFECT AT ADOPTION OF PART 25.

a. Regulation.

(a) Baggage and cargo compartments, and ballast location. Each baggage and cargo compartment, and each ballast location must have a placard stating any limitations on contents, including weight, that are necessary under the loading conditions.

(c) Emergency exit placards. Each emergency exit placard must meet the requirements of § 25.811.

(d) Doors. Each door that must be used in order to reach any required emergency exit must have a suitable placard stating that the door is to be latched in the open position during take off and landing.

b. Guidance. There is no guidance for this regulation.

1062. AMENDMENT 25-32, Effective May 1, 1972.

a. Regulation.

(a) Baggage and cargo compartments and ballast location. Each baggage and cargo compartment, and each ballast location must have a placard stating any limitations on contents, including weight, that are necessary under the loading requirements. However, underseat compartments designed for the storage of carry-on articles weighing not more than 20 pounds need not have a loading limitation placard.

b. Guidance. There is no guidance for this amendment.

1063. AMENDMENT 25-38, Effective February 1, 1977.

a. Regulation. -- Amendment 25-38 Did Not Change Paragraphs (a), (c), or (d).

b. Guidance. There is no guidance for this amendment.

1064 - 1100. [RESERVED]

SECTION 25.1561 SAFETY EQUIPMENT

1101. REGULATION IN EFFECT AT ADOPTION OF PART 25.

a. Regulation.

(a) Each safety equipment control to be operated by the crew in emergency, such as controls for automatic life raft releases, must be plainly marked as to its method of operation.

(b) Each location, such as a locker or compartment, that carries any fire extinguishing, signaling or other life saving equipment must be marked accordingly.

(c) Stowage provisions for required emergency equipment must be conspicuously marked to identify the contents and facilitate removal of the equipment.

(d) Each life raft must have obviously marked operating instructions.

(e) Approved survival equipment must be marked for identification and method of operation.

b. Guidance.

(1) Paragraph (b). Equipment such as fire extinguishers, located in clear view, need not have an arrow or other indicators pointing to location. However, the location should be clearly marked to indicate what equipment goes in that location should that equipment be removed.

(2) Paragraph (c). If the slide, slide/raft and/or locator transmitter is installed in a container on the exit, the container should be marked "SLIDE," "SLIDE/RAFT," and/or "LOCATOR TRANSMITTER," as applicable. (See paragraphs 101b(1), 801b(1)(ii), and 1041b(5).)

1102. AMENDMENT 25-46, Effective December 1, 1978.

a. Change to Regulation.

(c) Stowage provisions for required emergency equipment must be conspicuously marked to identify the contents and facilitate the easy removal of the equipment.

b. Guidance. There is no additional guidance for this amendment.

1103 - 1150. [RESERVED]

APPENDIX F TO PART 25
ACCEPTABLE TEST PROCEDURES FOR SHOWING COMPLIANCE WITH 25.853, 25.855, and 25.1359

1151. APPENDIX F Did Not Exist at Adoption of Part 25.

1152. AMENDMENT 25-15, Effective October 24, 1967.

AN ACCEPTABLE TEST PROCEDURE FOR SHOWING COMPLIANCE WITH § 25.853

(a) Conditioning. Specimens must be conditioned at 70° F. plus or minus 5°, and at 50 percent plus or minus 5 percent relative humidity until moisture equilibrium is reached. Only one specimen at a time may be removed from the conditioned environment immediately before subjecting it to the flame.

(b) Specimen configuration. The specimen must be no thicker than the minimum thickness to be qualified for use in the airplane. Rigid and flexible specimens, 4-l/2 inches by 12-1/2 inches, or the actual size used in the airplane must be clamped in a metal frame so that the two long edges and one end are held securely. The frame must be such that the exposed area is at least 2 inches wide and 11-l/2 inches long unless the actual size used in the airplane is smaller. In the case of fabrics, the direction of the weave corresponding to the most critical burn rate must be parallel to the longest dimension.

(c) Apparatus. The tests must be conducted in a sheet metal cabinet of approximate size provided with a door containing a glass insert for observing the burning specimen. The cabinet top must contain a baffled vent. There must be baffled holes or similar means of ventilation near the bottom of the cabinet. Larger panels need not be tested in this apparatus but must be tested in similar draft free conditions.

(d) Horizontal test. A minimum of three specimens must be tested and the results averaged. Each specimen must be supported horizontally. The surface exposed to the air when installed in the aircraft must be face down for the test. The specimen must be ignited by a Bunsen burner or Tirrill burner with a nominal three-eighths-inch internal diameter (I.D.) tube adjusted to give a flame of 1-1/2 inches in height with the air completely shutoff. The specimen must be positioned so that the edge being tested is three-fourths inch above the top of, and on the center line of, the burner. The flame must be applied for 15 seconds and then removed. Char length must be noted when testing for compliance with § 25.853(a). To determine burn rate for compliance with § 25.853(b), a minimum of 10 inches of the specimen must be used for timing purposes, approximately 1-1/2 inches must burn before the burning front reaches the timing zone, and the average burn rate must not exceed 4 inches per minute. If, in testing for compliance with § 25.853(b), the specimens do not support combustion after the ignition flame is applied for 15 seconds, or if the flame extinguishes itself and subsequent burning without a flame does not extend into the undamaged areas, the material is also acceptable.

(e) Vertical test. A minimum of three specimens must be tested and the results averaged. Each specimen must be supported vertically. Ceiling or floor panels may be tested with any edge down. Rigid specimens of materials mounted vertically in the airplane must be oriented for the test in the same manner as oriented in the airplane. The specimen must be ignited by a Bunsen or Tirrill burner with a nominal 3/8-inch I.D. tube adjusted to give a flame of 1-1/2 inches in height with the air completely shut off. The center line of the burner must be in line with a surface of the material being tested or, in the case of fabricated units, must be in line with the surface exposed to the air in the airplane. The lower edge of the specimen being tested must be three-fourths inch above the top of the burner. The flame must be applied for 12 seconds and then removed. Char length must be noted.

(f) Char length. Char length for fabrics and coated fabrics is the distance from the specimen end that was exposed to the flame to the end of a tear made lengthwise on the specimen through the center of the charred area. The test must be made as follows: A hook must be inserted in the specimen at one side of the charred areas one-fourth inch from the adjacent outside edge and one-fourth inch in from the charred end of the specimen. A weight of sufficient size such that the weight and hook together equal the total tearing load specified below must be applied gently to the specimen by grasping the corner of the cloth at the opposite edge of the char from the load and raising the specimen and weight clear of the support. The total tearing load for various weights per square yard of test cloth is as follows:

Weight per square yard of test cloth (ounces)	Total tearing load (pounds)
2 to 6	0.25
Over 6 to 15	0.5
Over 15 to 23	0.75
Over 23	l.0

On materials other than fabrics, the char length is the total length of the specimen consumed or charred by burning. The length is measured from the ignition edge to a point that is not punctured by a ballpoint pen (or equivalent) when progressively moved from unburned to burned areas.

1153. AMENDMENT 25-32, Effective May 1, 1972.

AN ACCEPTABLE TEST PROCEDURE FOR SHOWING COMPLIANCE WITH §§ 25.853, 25.855 AND 25.1359

(a) Conditioning. Specimens must be conditioned to 70 degrees F. plus or minus 5°, and at 50 percent plus or minus 5 percent relative humidity until moisture equilibrium is reached or for 24 hours. Only one specimen at a time may be removed from the conditioning environment immediately before subjecting it to the flame.

(b) Specimen configuration. Except as provided for materials used in electrical wire and cable insulation and in small parts, materials must be tested either as a section cut from a fabricated part as installed in the airplane or as a specimen simulating a cut section, such as: a specimen cut from a flat sheet of the material or a model of the fabricated part. The specimen may be cut from any location in a fabricated part; however, fabricated units, such as sandwich panels, may not be separated for test. The specimen thickness must be no thicker than the minimum thickness to be qualified for use in the airplane, except that: (1) thick foam parts, such as seat cushions, must be tested in 1/2-inch thickness; (2) when showing compliance with § 25.853(b-3) for materials used in small parts that must be tested, the materials must be tested in no more than 1/8-inch thickness; (3) when showing compliance with § 25.1359(d) for materials used in electrical wire and cable insulation, the wire and cable specimens must be the same size as used in the airplane. In the case of fabrics, both the warp and fill direction of the weave must be tested to determine the most critical flammability condition. When performing the tests prescribed in paragraphs (d) through (e) of this Appendix, the specimen must be mounted in a metal frame so that; (1) in the vertical tests of paragraph (d), the two long edges and the upper edge are held securely; (2) in the horizontal test of paragraph (e), the two long edges and the edge away from the flame are held securely; (3) the exposed area of the specimen is at least 2 inches wide and 12 inches long, unless the actual size used in the airplane is smaller; and (4) the edge to which the burner flame is applied must not consist of the finished or protected edge of the specimen but must be representative of the actual cross-section of the material or part installed in the airplane. When performing the test prescribed in paragraph (f) of this Appendix, the specimen must be mounted in a metal frame so that all four edges are held securely and the exposed area of the specimen is at least 8 inches by 8 inches.

(c) Apparatus. Except as provided in paragraph (g) of this Appendix, tests must be conducted in a draft-free cabinet in accordance with Federal Test Method Standard 191 Method 5903 (revised Method 5902) for the vertical test, or Method 5906 for horizontal test (available from the General Services Administration, Business Service Center, Region 3, Seventh & D Streets, S.W., Washington, D.C., 20407) or other approved equivalent methods. Specimens which are too large for the cabinet must be tested in similar draft-free conditions.

(d) Vertical test, in compliance with § 25.853(a) and (b). A minimum of three specimens must be tested and the results averaged. For fabrics, the direction of weave corresponding to the most critical flammability conditions must be parallel to the longest dimension. Each specimen must be supported vertically. The specimen must be exposed to a Bunsen or Tirrill burner with a nominal 3/8-inch I.D. tube adjusted to give a flame of 1-1/2 inches in height. The minimum flame temperature measured by a calibrated thermocouple pyrometer in the center of the flame must be 1550 degrees F. The lower edge of the specimen must be three-fourths inch above the top edge of the burner. The flame must be applied to the center line of the lower edge of the specimen. For materials covered by § 25.853(a), the flame must be applied for 60 seconds and then removed. For materials covered by § 25.853(b), the flame must be applied for 12 seconds and then removed. Flame time, burn length, and flaming time of drippings, if any, must be recorded. The burn length determined in accordance with paragraph (h) of this Appendix must be measured to the nearest 1/10-inch.

(e) Horizontal test in compliance with § 25.853(b-2) and (b-3). A minimum of three specimens must be tested and the results averaged. Each specimen must be supported horizontally. The exposed surface when installed in the aircraft must be face down for the test. The specimen must be exposed to a Bunsen burner or Tirrill burner with a nominal 3/8-inch I.D. tube adjusted to give a flame of 1-1/2 inches in height. The minimum flame temperature measured by a calibrated thermocouple pyrometer in the center of the flame must be 1550 degrees F. The specimen must be positioned so that the edge being tested is three-fourths of an inch above the top of, and on the center line of, the burner. The flame must be applied for 15 seconds and then removed. A minimum of 10 inches of the specimen must be used for timing purposes, approximately 1-1/2 inches must burn before the burning front reaches the timing zone, and the average burn rate must be recorded.

(f) Forty-five degree test, in compliance with § 25.855(a-1). A minimum of three specimens must be tested and the results averaged. The specimens must be supported at an angle of 45 degrees to a horizontal surface. The exposed surface when installed in the aircraft must be face down for the test. The specimens must be exposed to a Bunsen or Tirrill burner with a nominal 3/8-inch I.D. tube adjusted to give a flame of 1-1/2 inches in height. The minimum flame temperature measured by a calibrated thermocouple pyrometer in the center of the flame must be 1550 degrees F. Suitable precautions must be taken to avoid drafts. One-third of the flame must contact the material at the center of the specimen and must be applied for 30 seconds and then removed. Flame time, glow time, and whether the flame penetrates (passes through) the specimen must be recorded.

(g) Sixty degree test in compliance with § 25.1359(d). A minimum of three specimens of each wire specification (make and size) must be tested. The specimen of wire or cable (including insulation) must be placed at an angle of 60 degrees with the horizontal in the cabinet specified in paragraph (c) of this Appendix with the cabinet door open during the test or must be placed within a chamber approximately 2 feet high x 1 foot x 1 foot, open at the top and at one vertical side (front), and which allows sufficient flow of air for complete combustion, but which is free from drafts. The specimen must be parallel to and approximately 6 inches from the front of the chamber. The lower end of the specimen must be held rigidly clamped. The upper end of the specimen must pass over a pulley or rod and must have an appropriate weight attached to it so that the specimen is held tautly throughout the flammability test. The test specimen span between lower clamp and upper pulley or rod must be 24 inches and must be marked 8 inches from the lower end to indicate the central point for flame application. A flame from a Bunsen or Tirrill burner must be applied for 30 seconds at the test mark. The burner must be mounted underneath the test mark on the specimen, perpendicular to the specimen and at an angle of 30 degrees to the vertical plane of the specimen. The burner must have a nominal bore of three-eighths inch, and must be adjusted to provide a 3-inch high flame with an inner cone approximately one third of the flame height. The minimum temperature of the hottest portion of the flame, as measured with a calibrated thermocouple pyrometer, may not be less than 1750 degrees F. The burner must be positioned so that the hottest portion of the flame is applied to the test mark on the wire. Flame time, burn length, and flaming time of drippings, if any, must be recorded. The burn length determined in accordance with

paragraph (h) of this Appendix must be measured to the nearest one-tenth inch. Breaking of the wire specimens is not considered a failure.

(h) Burn length. Burn length is the distance from the original edge to the farthest evidence of damage to the test specimen due to flame impingement, including areas of partial or complete consumption, charring, or embrittlement, but not including areas sooted stained, warped, or discolored, nor areas where material has shrunk or melted away from the heat source.

1154. AMENDMENT 25-55, Effective April 26, 1982. References to paragraphs (g) and (h) from Amendment 25-32 were corrected by this amendment. The typing errors are shown corrected in Amendment 25-32 above.

1155. AMENDMENT 25-59, Effective November 26, 1984.

PART I - AN ACCEPTABLE TEST PROCEDURE FOR SHOWING COMPLIANCE WITH §§ 25.853, 25.855 AND 25.1359

This amendment titled the existing Appendix as Part I and added Part II. Part 25

PART II - FLAMMABILITY OF SEAT CUSHIONS

(a) Criteria for Acceptance. Each seat cushion must meet the following criteria:

(1) At least three sets of seat bottom and seat back cushion specimens must be tested.

(2) If the seat cushion is constructed with a fire blocking material, the fire blocking material must completely enclose the cushion foam core material.

(3) Each specimen tested must be fabricated using the principal components (i.e., foam core, flotation material, fire blocking material, if used, and dress covering) and assembly processes (representative seams and closures) intended for use in the production articles. If a different material combination is used for the back cushion than for the bottom cushion, both material combinations must be tested as complete specimen sets, each set consisting of a back cushion specimen and a bottom cushion specimen. If a cushion, including outer dress covering, is demonstrated to meet the requirements of this Appendix using the oil burner test, the dress covering of that cushion may be replaced with a similar dress covering provided the burn length of the replacement covering, as determined by the test specified in § 25.853(b), does not exceed the corresponding burn length of the dress covering used on the cushion subjected to the oil burner test.

(4) For at least two-thirds of the total number of specimen sets tested, the burn length from the burner must not reach the side of the cushion opposite the burner. The burn length must not exceed 17 inches. Burn length is the perpendicular distance from the inside edge of the seat frame closest to the burner to the farthest evidence of damage to the test specimen due to flame impingement, including areas of partial or complete consumption,

charring, or embrittlement, but not including areas sooted, stained, warped, or discolored, or areas where material has shrunk or melted away from the heat source.

(5) The average percentage weight loss must not exceed 10 percent. Also, at least two-thirds of the total number of specimen sets tested must not exceed 10 percent weight loss. All droppings falling from the cushions and mounting stand are to be discarded before the after-test weight is determined. The percentage weight loss for a specimen set is the weight of the specimen set before testing less the weight of the specimen set after testing expressed as the percentage of the weight before testing.

(b) Test Conditions. Vertical air velocity should average 25 fpm $\pm$ 10 fpm at the top of the back seat cushion. Horizontal air velocity should be below 10 fpm just above the bottom seat cushion. Air velocities should be measured with the ventilation hood operating and the burner motor off.

(c) Test Specimens.

(1) For each test, one set of cushion specimens representing a seat bottom and seat back cushion must be used.

(2) The seat bottom cushion specimen must be 18$\pm$1/8 inches (457$\pm$3mm) wide by 20$\pm$1/8 inches (508$\pm$3mm) deep by 4$\pm$1/8 inches (102$\pm$3mm) thick, exclusive of fabric closures and seam overlap.

(3) The seat back cushion specimen must be 18$\pm$1/8 inches (432$\pm$3mm) wide by 25$\pm$1/8 inches (635$\pm$3mm) high by 2 $\pm$ 1/8 inches (51$\pm$3mm) thick, exclusive of fabric closures and seam overlap.

(4) The specimens must be conditioned at 70$\pm$5 degrees F (21$\pm$2°C) 55%$\pm$10% relative humidity for at least 24 hours before testing.

(d) Test Apparatus. The arrangement of the test apparatus is shown in Figures 1 through 5 and must include the components described in this section. Minor details of the apparatus may vary, depending on the model burner used.

(1) Specimen Mounting Stand. The mounting stand for the test specimens consists of steel angles, as shown in Figure 1. The length of the mounting stand legs is 12$\pm$1/8 inches (305$\pm$3mm). The mounting stand must be used for mounting the test specimen seat bottom and seat back, as shown in Figure 2. The mounting stand should also include a suitable drip pan lined with aluminum foil, dull side up.

(2) Test Burner. The burner to be used in testing must--

(i) Be a modified gun type;

(ii) Have an 80-degree spray angle nozzle nominally rated for 2.25 gallons/hour at 100 psi;

(iii) Have a 12-inch (305mm) burner cone installed at the end of the draft tube, with an opening 6 inches (152mm) high and 11 inches (280mm) wide, as shown in Figure 3; and

(iv) Have a burner fuel pressure regulator that is adjusted to deliver a nominal 2.0 gallon/hour of #2 Grade kerosene or equivalent required for the test.

Burner models which have been used successfully in testing are the Lennox Model OB-32, Carlin Model 200 CRD, and Park Model DPL 3400. FAA published reports pertinent to this type of burner are: (1) Powerplant Engineering Report No. 3A, Standard Fire Test Apparatus and Procedure for Flexible Hose Assemblies, dated March 1978; and (2) Report No. DOT/FAA/RD/76/213, Reevaluation of Burner Characteristics for Fire Resistance Tests, dated January 1977.

(3) Calorimeter.

(i) The calorimeter to be used in testing must be a 0-15.0 BTU/ft2-sec. (0-17.0 W/cm2) calorimeter, accurate +3%, mounted in a 6-inch by 12-inch (152 by 305mm) by 3/4-inch (19mm) thick calcium silicate insulating board which is attached to a steel angle bracket for placement in the test stand during burner calibration, as shown in Figure 4.

(ii) Because crumbling of the insulating board with service can result in misalignment of the calorimeter, the calorimeter must be monitored and the mounting shimmed, as necessary, to ensure that the calorimeter face is flush with the exposed plane of the insulating board in a plane parallel to the exit of the test burner cone.

(4) Thermocouples. The seven thermocouples to be used for testing must be 1/16 to 1/8-inch metal sheathed, ceramic packed, type K, grounded thermocouples with a nominal 22 to 30 American wire gage (AWG)-size conductor. The seven thermocouples must be attached to a steel angle bracket to form a thermocouple rake for placement in the test stand during burner calibration, as shown in Figure 5.

(5) Apparatus Arrangement. The test burner must be mounted on a suitable stand to position the exit of the burner cone a distance of 4+1/8 inches (102+3mm) from one side of the specimen mounting stand. The burner stand should have the capability of allowing the burner to be swung away from the specimen mounting stand during warm-up periods.

(6) Data Recording. A recording potentiometer or other suitable calibrated instrument with an appropriate range must be used to measure and record the outputs of the calorimeter and the thermocouples.

(7) Weight Scale. Weighing Device--A device must be used that with proper procedures may determine the before and after test weights of each set of seat cushion specimens within 0.02 pound (9 grams). A continuous weighing system is preferred.

(8) Timing Device. A stopwatch or other device (calibrated to ±1 second) must be used to measure the time of application of the burner flame and self-extinguishing time or test duration.

(e) Preparation of Apparatus. Before calibration, all equipment must be turned on and the burner fuel must be adjusted as specified in paragraph (d)(2).

(f) Calibration. To ensure the proper thermal output of the burner, the following test must be made:

(1) Place the calorimeter on the test stand as shown in Figure 4 at a distance of 4±1/8 inches (102±3mm) from the exit of the burner cone.

(2) Turn on the burner, allow it to run for 2 minutes for warm-up, and adjust the burner air intake damper to produce a reading of 10.5±0.5BTU/ft2sec, (11.9±0.6w/cm2) on the calorimeter to ensure steady state conditions have been achieved. Turn off the burner.

(3) Replace the calorimeter with the thermocouple rake (Figure 5).

(4) Turn on the burner and ensure that the thermocouples are reading 1900±100F (1038±38C) to ensure steady state conditions have been achieved.

(5) If the calorimeter and thermocouples do not read within range, repeat steps in paragraphs 1 through 4 and adjust the burner air intake damper until the proper readings are obtained. The thermocouple rake and the calorimeter should be used frequently to maintain and record calibrated test parameters. Until the specific apparatus has demonstrated consistency, each test should be calibrated. After consistency has been confirmed, several tests may be conducted with the pre-test calibration before and a calibration check after the series.

(g) Test Procedure. The flammability of each set of specimens must be tested as follows:

(1) Record the weight of each set of seat bottom and seat back cushion specimens to be tested to the nearest 0.02 pound (9 grams).

(2) Mount the seat bottom and seat back cushion test specimens on the test stand as shown in Figure 2, securing the seat back cushion specimen to the test stand at the top.

(3) Swing the burner into position and ensure that the distance from the exit of the burner cone to the side of the seat bottom cushion specimen is 4±1/8 inches (102±3mm).

(4) Swing the burner away from the test position. Turn on the burner and allow it to run for 2 minutes to provide adequate warm-up of the burner cone and flame stabilization.

(5) To begin the test, swing the burner into the test position and simultaneously start the timing device.

(6) Expose the seat bottom cushion specimen to the burner flame for 2 minutes and then turn off the burner. Immediately swing the burner away from the test position. Terminate test 7 minutes after initiating cushion exposure to the flame by use of a gaseous extinguishing agent (i.e., Halon or CO2).

(7) Determine the weight of the remains of the seat cushion specimen set left on the mounting stand to the nearest 0.02 pound (9 grams) excluding all droppings.

(h) Test Report. With respect to all specimen sets tested for a particular seat cushion for which testing of compliance is performed, the following information must be recorded:

(1) An identification and description of the specimens being tested.

(2) The number of specimen sets tested.

(3) The initial weight and residual weight of each set, the calculated percentage weight loss of each set, and the calculated average percentage weight loss for the total number of sets tested.

(4) The burn length for each set tested.

[INSERT PART II FIGURES 1 THROUGH 5]

1156. APPENDIX 25-60, Effective June 16, 1986. This amendment added Part III.

PART III - TEST METHOD TO DETERMINE FLAME PENETRATION RESISTANCE OF CARGO COMPARTMENT LINERS.

(a) Criteria for Acceptance.

(1) At least three specimens of cargo compartment sidewall or ceiling liner panels must be tested.

(2) Each specimen tested must simulate the cargo compartment sidewall or ceiling liner panel, including any design features. such as joints, lamp assemblies, etc., the failure of which would affect the capability of the liner to safely contain a fire.

(3) There must be no flame penetration of any specimen within 5 minutes after application of the flame source and the peak temperature measured at 4 inches above the upper surface of the horizontal test sample must not exceed 400 F.

(b) Summary of Method. This method provides a laboratory test procedure for measuring the capability of cargo compartment lining materials to resist flame penetration with a 2 gallon per hour (gph) #2 Grade kerosene or equivalent burner fire source. Ceiling and sidewall liner panels may be tested individually provided a baffle is used to-simulate the missing panel. Any specimen that passes the test as a ceiling liner panel may be used as a sidewall liner panel.

(c) Test Specimens.

(1) The specimen to be tested must measure 16 ± 1/8 inches (406 ± 3 mm) by 24 + 1/8 inches (610 ± 3 mm).

(2) The specimens must be conditioned at 70 F ± 5 F. (21 C ± 2 C.) and 55% ± 5% humidity for at least 24 hours before testing.

(d) Test Apparatus. The arrangement of the test apparatus, which is shown in Figure 3 of Part II and Figures I through 3 of this Part of Appendix F, must include the components described in this section. Minor details of the apparatus may vary, depending on the model of the burner used.

(1) Specimen Mounting Stand. The mounting stand for the test specimens consists of steel angles as shown in Figure 1.

(2) Test Burner. The burner to be used in testing must--

(i) Be a modified gun type.

(ii) Use a suitable nozzle and maintain fuel pressure to yield a 2 GPH fuel flow. For example: an 80 degree nozzle nominally rated at 2.25 GPH and operated at 85 pounds per square inch (PSI) gage to deliver 2.03 GPH.

(iii) Have a 12-inch (305 mm) burner extension installed at the end of the draft tube with an opening 6 inches (152 mm) high and 11 inches (280 mm) wide as shown in Figure 3 of Part II of this Appendix

(iv) Have a burner fuel pressure regulator that is adjusted to deliver a nominal 2.0 GPH of #2 Grade kerosene or equivalent.
Burner models which have been used successfully in testing are the Lenox Model OB-32, Carlin Model 200 CRD and Park Model DPL The basic burner is described in FAA Powerplant Engineering Report No. 3A, Standard Fire Test Apparatus and Procedure for Flexible Hose Assemblies, dated March 1978; however, the test settings specified in this Appendix differ in some instances from those specified in the report.

(3) Calorimeter.

(i) The calorimeter to be used in testing must be a total heat flux Foil Type Gardon Gage of an appropriate range (approximately 0 to 15.0 British thermal unit (BTU) per $ft.^2$ sec., 0-17.0 watts/cm^2. The calorimeter must .be mounted in a 6-inch by 12-inch (152 by 305 mm) by 3/4-inch (19 mm) thick insulating block which is attached to a steel angle bracket for placement in the test stand during burner calibration as shown in Figure 2 of this Part of this Appendix.

(ii) The insulating block must be monitored for deterioration and the mounting shimmed as necessary to ensure that the calorimeter face is parallel to the exit plane of the test burner cone..

(4) Thermocouples. The seven thermocouples to be used-for testing must be 1/16-inch ceramic sheathed, type K, grounded thermocouples with a nominal 30 American wire gage (AWG) size conductor. The seven thermocouples must be attached to a steel angle bracket to form a thermocouple rake for placement in the test stand during burner calibration as shown in Figure 3 of this Part of this Appendix.

(5) Apparatus Arrangement. The test burner must be mounted on a suitable stand to position the exit of the burner cone a distance of 8 inches from the ceiling liner panel and 2 inches from the sidewall liner panel. The burner stand should have the capability of allowing the burner to be swung away from the test specimen during warm-up periods.

(6) Instrumentation. A recording potentiometer or other suitable instrument with an appropriate range must be used to measure and record the outputs of the calorimeter and the thermocouples.

(7) Timing Device. A stopwatch or other device must be used to measure the time of flame application and the time of flame penetration, if it occurs.

(e) Preparation of Apparatus. Before calibration, all equipment must be turned on and allowed to stabilize, and the burner fuel flow must be adjusted as specified in paragraph (d)(2).

(f) Calibration. To ensure the proper thermal output of the burner the following test must be made:

(1) Remove the burner extension from the end of the draft tube. Turn on the blower portion of the burner without turning the fuel or ignitors on. Measure the air velocity using a hot wire anemometer in the center of the draft tube across the face of the opening. Adjust the damper such that the air velocity is in the range of 1550 to 1800 ft./min. If tabs are being used at the exit of the draft tube, they must be removed prior to, this measurement. Reinstall the draft tube extension cone.

(2) Place the calorimeter on the test stand as shown in Figure 2 at a distance of 8 inches (203 mm) from the exit of the burner cone to simulate the position of the horizontal test specimen.

(3) Turn on the burner, allow it to run for 2 minutes for warm-up, and adjust the damper to produce a-calorimeter reading of 8.0 ± 0.5 BTU per ft.^{2} sec. (9.1 ± 0.6 Watts/cm^2).

(4) Replace the calorimeter with the thermocouple rake (see Figure 3).

(5) Turn on the burner and ensure that each of the seven thermocouples reads 1700 F.± 100 F. (927 C. ± 38 C.) to ensure steady state conditions have been achieved. If the temperature is out of this range, repeat steps 2 through 5 until proper readings are obtained.

(6) Turn off the burner and remove the thermocouple rake.

(7) Repeat (1) to ensure that the burner is in the correct range.

(g) Test Procedure.

(1) Mount a thermocouple of the same type as that used for calibration at a distance of 4 inches (102 mm) above the horizontal (ceiling) test specimen. The thermocouple should be centered over the burner cone.

(2) Mount the test specimen on the test stand shown in Figure 1 in either the horizontal or vertical position. Mount the insulating material in the other position.

(3) Position the burner so that flames will not impinge on the specimen, turn the burner on, and allow it to run for 2 minutes. Rotate the burner to apply the flame to the specimen and simultaneously start the timing device.

(4) Expose the test specimen to the flame for 5 minutes and then turn off the burner. The test may be terminated earlier if flame penetrations observed.

(5) When testing ceiling liner panels, record the peak temperature measured 4 inches above the sample.

(6) Record the time at which flame penetration occurs if applicable.

(h) Test Report. The test report must include the following:

(1) A complete description of the materials tested including type, manufacturer, thickness, and other appropriate data.

(2) Observations of the behavior of the test specimens during flame exposure such as delamination, resin ignition, smoke, etc., including the time of such occurrence.

(3).The time at which flame penetration occurs, if applicable, for each of the three specimens tested.
(4) Panel orientation (ceiling or sidewall).

[INSERT PART III FIGURES 1 THROUGH 3]

1157. APPENDIX 25-61, Effective August 20, 1986. This amendment added Part IV.

PART IV - TEST METHOD TO DETERMINE THE HEAT RELEASE RATE FROM CABIN MATERIALS EXPOSED TO RADIANT HEAT

(a) Summary of Method. The specimen to be tested is injected into an environmental chamber through which a constant flow of air passes. The specimen's exposure is determined by a radiant heat source adjusted to produce the desired total heat flux on the specimen of 3.5 W/cm^2. using a calibrated calorimeter. The specimen is tested so that the exposed surface is vertical. Combustion Is initiated by piloted ignition. The combustion products leaving the chamber are monitored in order to calculate the release rate of heat.

(b) Apparatus. The Ohio State University (OSU) rate of heat release apparatus, as described below, is used. This is a modified version of the rate of heat release apparatus standardized by the American Society of Testing and Materials (ASTM), ASTM E-906.

(1) This apparatus is shown In Figure 1. All exterior surfaces of the apparatus, except the holding chamber. shall be insulated with 25 mm thick, low density, high temperature, fiberglass board insulation. A gasketed door through which the sample injection rod slides forms an airtight closure on the specimen hold chamber.

(2) Thermopile. The temperature difference between the air entering the environmental chamber and that leaving is monitored by a thermopile having three hot and three cold, 32-gauge Chromel-Alumel junctions. The hot Junctions are spaced across the top of the exhaust stack. Two hot junctions are located 25 mm from each side on diagonally opposite corners, and the third in the center of the chimney's cross-section 10 mm below the top of the chimney. The cold junctions are located in the pan below the lower air distribution plate (see paragraph (b)(4)).

(i) Thermal Inertia Compensator. A compensator tab is made from 0.55 mm stainless steel sheet, 10 by 20 mm. An 800 mm length of 24-gauge Chromel-Alumel, glass insulated, duplex thermocouple wire is welded or silver soldered to the tab as shown in Figure 2, and the wire bent back so that it is flush against the metal surface.

(ii) The compensator tab must be mounted on the exhaust stack as shown in Figure 3 using a 6-32 round head machine screw, 12 mm long. Add small (approximately 4.5 mm O.D., 9 mm O.D.) washers between the head of the machine screw and the compensator tab to give the best response to a square wave input. (One or two washers should be adequate.) The "sharpness" of the square wave can be increased by changing the ratio of the output from the thermopile and compensator thermocouple which is fed to the recorder. The ratio is changed by adjusting the 1-K ohm variable resistor (R_1) of the thermopile bleeder shown in Figure 4. When adjusting compensation, keep R_1 as small as possible. Adjustment of the compensator must be made during calibration (see paragraph (c)(1)) at a heat release rate of 7.0 plus or minus 0.5 kW.

(iii) Adjust the washers and the variable resistor (R_1) so that 90 percent of full scale response is obtained in 8 to 10 seconds. There must be no overshoot, as shown in Figure 5A. If an insufficient number of washers is added, or R_1 is too small, the output with square wave input will look like Figure 5B; if too many washers are added and R_1 is too large, the output will look like Figure 5A.

(iv) Subtract the output of the compensator from the thermopile. The junctions enclosed in the dotted circle of Figure 4 are kept at the same constant temperature by electrically insulating the junctions and placing them on the pipe carrying air to the manifold, then covering them and the pipe with thermal insulation.

(v) Thermopile hot junctions must be cleared of soot deposits on a daily basis during periods of testing.

(3) Radiation Source. A radiant heat source for generating a flux up to 100 kW/ m^2, using four silicon carbide elements, Type LL, 20 inches (50.8 cm) long by 5/8-inch (1.54 cm) O.D., nominal resistance 1.4 ohms, is shown in Figures 6A and 6B. The silicon carbide elements are mounted in the stainless steel panel box by inserting them through 15.9 mm holes in 0.8 mm thick ceramic fiber board. Location of the holes in the pads and stainless steel cover plates are shown In Figure 6B. The diamond shaped mask of 24-gauge stainless steel is added to provide uniform heat flux over the area occupied by the 150 by 150 mm vertical sample. A power supply of 12.5 kVA. adjustable from 0 to 270 volts, is required.

(4) Air Distribution System. The air entering the environmental chamber is distributed by a 6.3 mm thick aluminum plate having eight, No. 4 drill holes, 51 mm from sides on 102 mm centers, mounted at the base of the environmental chamber. A second plate of 18-gauge steel having 120, evenly spaced, No. 28 drill holes is mounted 150 mm above the aluminum plate. A well regulated air supply is required. The air supply manifold at the base of the pyramidal section has 48, evenly spaced, No. 26 drill holes located 10 mm from the inner edge of the manifold so that 0.03 m^3/second of air flows between the pyramidal sections and 0.01 m^3/second flows through the environmental chamber when total air flow to apparatus is controlled at 0.04 m^3/second.

(5) Exhaust Stack. An exhaust stack, 133 mm by 70 mm in cross section, and 254 mm long, fabricated from 28-gauge stainless steel, is mounted on the outlet of the pyramidal section. A 25 mm by 76 mm plate of 31-gauge stainless steel is centered inside the stack, perpendicular to the air flow, 75 mm above the base of the stack.

(6) Specimen Holders. The 150 mm x 150 mm specimen is tested in a vertical orientation. The holder (Figure 7) is provided with a specimen holder frame, which touches the specimen (which is wrapped with aluminum foil as required by paragraph (d)(3) of this Part) along only the 10 mm perimeter, and a "V" shaped spring to hold the assembly together. A detachable 12 mm x 12 mm x 150 mm drip pan is also provided for testing of materials prone to melting and dripping. The positioning of the spring and

frame may be changed to accommodate different specimen thicknesses by inserting the retaining rod in different holes on the specimen holder.

Since the radiation shield described in ASTM E-906 is not used, a guide pin is added to the injection mechanism. This fits into a slotted metal plate on the injection mechanism outside of the holding chamber and can be used to provide accurate positioning of the specimen face after injection. The front surface of the specimen shall be 100 mm from the closed radiation doors after injection.

The specimen holder clips onto the mounted bracket (Figure 7). The mounting bracket is attached to the injection rod by three screws which pass through a wide area washer welded onto a 1/2- inch nut. The end of the injection rod is threaded to screw into the nut and a .020-inch thick wide area washer is held between two 1/2- inch nuts which are adjusted to tightly cover the hole in the radiation doors through which the injection rod or calibration calorimeter pass.

(7) Radiometers. A total-flux flush (calorimeter) mounted in the center of a 1/2 -inch Kaowool "M" board inserted in the sample holder must be used to measure the total heat flux. The total-flux calorimeter must have a view angle of 180 degrees and be calibrated for incident flux. The calorimeter calibration must be acceptable to the Administrator.

(8) Pilot-Flame Positions. Pilot ignition of the specimen must be accomplished by simultaneously exposing the specimen to a lower pilot burner and an upper pilot burner, as described in paragraph (b)(8)(i) and (b)(8)(ii), respectively.

(i) Lower Pilot Burner. The pilot-flame tubing must be 6.3 mm O.D., 0.8 mm wall. stainless steel tubing. A mixture of 120 cm^3/ min. of methane and 850 cm^3/min. of air must be fed to the lower pilot name burner. The normal position of the end of the pilot burner tubing is 10 mm from, and perpendicular to, the exposed vertical surface of the specimen. The centerline at the outlet of the burner tubing must intersect the vertical centerline of the sample at a point 5 mm above the lower edge of the specimen. .

(ii) Upper Pilot Burner. The pilot burner must be a straight length of 6.3 mm O.D., 0.8 mm wall, stainless steel tubing that is 360 mm long. One end of the tubing shall be closed, and three No. 40 drill holes shall be drilled into the tubing, 60 mm apart, for gas ports, all radiating in the same direction. The first hole must be 5 mm from the closed end of the tubing. The tube is inserted into the environmental chamber through a 6.6 mm hole drilled 10 mm above the upper edge of the window frame. The tube is supported and positioned by an adjustable "Z" shaped support mounted outside the environmental chamber, above the viewing window. The tube is positioned above and 20 mm behind the exposed upper edge of the specimen. The middle hole must be in the vertical plane perpendicular to the exposed surface of the specimen which passes through its vertical centerline and must be pointed toward the radiation source. The gas supplied to the burner must be methane adjusted to produce flame lengths of 25 mm.

(c) Calibration of Equipment.

(1) Heat Release Rate. A burner as shown In Figure 8 must be placed over the end of the lower pilot flame tubing using a gas-tight connection. The flow of gas to the pilot flame must be at least 99 percent methane and must be accurately metered. Prior to usage, the wet test meter is properly leveled and filled with distilled water to the tip of the internal pointer while no gas is flowing. Ambient temperature and pressure of the water are based on the internal wet test meter temperature. A baseline flow rate of approximately 1 liter/min is set and increased to higher preset flows of 2, 4, 6, and 8 liters/ min. The rate is determined by using a stop watch to time a complete revolution of the wet test meter for both the baseline and higher flow, with the flow returned to base-line before changing to the next higher flow. The thermopile baseline voltage is measured. The gas flow to the burner must be increased to the higher preset flow and allowed to burn for 4.0 minutes, and the thermopile voltage must be measured. The sequence is repeated until all four values have been determined. The average of the four values must be used as the calibration factor. The procedure must be repeated if the percent relative standard deviation is greater than 5 percent. Calculations are shown in paragraph (f).

(2) Flux Uniformity. Uniformity of flux over the specimen must be checked periodically and after each heating element change to determine if it is within acceptable limits of plus or minus 5 percent.

(d) Sample Preparation.

(1) The standard size for vertically mounted specimens is 150 x 150 mm for exposed surface with thickness up to 100 mm.

(2) Conditioning. Specimens must be conditioned as described in Part I of this appendix.

(3) Mounting. Only one surface of a specimen will be exposed during a test. A single layer of 0.025 mm aluminum foil is wrapped tightly on all unexposed sides.

(e) Procedure.

(1) The power supply to the radiant panel is set to produce a radiant flux of 3.5 W/cm^2. The flux is measured at the point which the center of the specimen surface will occupy when positioned for test. The radiant flux is measured after the air flow through the equipment is adjusted to the desired rate. The sample should be tested in its end use thickness.

(2) The pilot flames are lighted and their position, as described in paragraph (b)(8), is checked.

(3) The air flow to the equipment is set at 0.04 plus or minus 0.001 m^3/s at atmospheric pressure. Proper air flow may be set and monitored by either: (1) An orifice meter designed to produce a pressure drop of at least 200 mm of the manometric fluid, or by; (2) A rotometer (variable orifice meter) with a scale capable of being read to plus or minus 0.0004 m^3/s. The stop on the vertical specimen holder rod is adjusted so that the

exposed surface of the specimen is positioned 100 mm from the entrance when injected into the environmental chamber.

(4) The specimen is placed in the hold chamber with the radiation doors closed. The airtight outer door is secured, and the recording devices are started. The specimen must be retained in the hold chamber for 60 seconds, plus or minus 10 seconds, before injection. The thermopile "zero" value is determined during the last 20 seconds of the hold period.

(5) When the specimen is to be injected, the radiation doors are opened, the specimen is injected into the environmental chamber, and the radiation doors are closed behind the specimen.

(6) A negative heat release will occur due to heat absorption by the cold specimen holder. Data acquisition devices must have the capability of following these negative outputs and correcting the sample burn with a "blank" test result.

(7) Injection of the specimen marks time zero. A continuous record of the thermopile output must be made during the time the specimen is in the environmental chamber.

(8) The test duration time is five minutes.

(9) A minimum of three specimens must be tested.

(f) Calculations.

(1) The calibration factor Is calculated as follows:

$$K_h = \frac{(F_1 - F_0)}{(V_1 - V_0)} \times \frac{(210.8 - 22)kcal}{mole} \times \frac{273}{T_a} \times \frac{P - P_v}{760} \times \frac{moleCH4STP}{22.41} \times \frac{WATT.\min}{.01433kcal} \times \frac{kw}{1000w}$$

F_o = flow of methane at baseline (1pm)
F_1 = higher preset flow of methane (1pm)
V_o=thermopile voltage at baseline (mv)
V_1 = thermopile voltage at higher flow (mv)
T_a = Ambient temperature (K)
P = Ambient pressure (mm Hg)
P_v = Water vapor pressure (mm Hg)

(2) Heat release rates may be calculate from the reading of the thermopile output voltage at any Instant of time as

$$HRR = \frac{(V_m - V_b)}{.02323m^2} \times K_h$$

HRR = Heat release Rate kw/m^2

V_m = measured thermopile voltage (mv)
V_b = "Blank" thermopile voltage
K_h = Calibration Factor (Kw/mv)

Vb is the "blank" test obtained by a run conducted with an empty sample holder assembly. See paragraph (7) above.

(3) The integral of the heat release rate is the total heat release as a function of time and is calculated by multiplying the rate by the data sampling frequency in minutes and summing the time from zero to two minutes.

(g) Criteria. The total positive heat release over the first two minutes of exposure for each of the three or more samples tested must be averaged, and the peak heat release rate for each of the samples must be averaged. The average total heat release must not exceed 65 kilowatt-minutes per square meter, and the average peak heat release rate must not exceed 65 kilowatts per square meter.

(h) Report. The test report must include the following for each specimen tested:

(1) Description of the specimen.

(2) Radiant heat flux to the specimen, expressed in W/cm^2.

(3) Data giving release rates of heat (in kW/m^2) as a function of time, either graphically or tabulated at intervals no greater than 10 seconds. The calibration factor (k_h) must be recorded.

(4) If melting, sagging, delaminating, or other behavior that affects the exposed surface area or the mode of burning occurs, these behaviors must be reported, together with the time at which such behaviors were observed.

(5) The peak heat release and the 2-minute integrated heat release rate must be reported.

[INSERT FIGURES]

1158. APPENDIX 25-66, Effective September 26, 1988. This amendment revised Part IV and added Part V.

PART IV - TEST METHOD TO DETERMINE THE HEAT RELEASE RATE FROM CABIN MATERIALS EXPOSED TO RADIANT HEAT

(b)(2) Thermopile. The temperature difference between the air entering the environmental chamber and that leaving is monitored by a thermopile having five hot and five cold, 24-gauge Chromel-Alumel junctions. The hot junctions are spaced across the top of the exhaust stack, 10 mm below the top of the chimney. One thermocouple is located in the geometric center, with the other four located 30 mm from the center along the diagonal toward each of the comers. The cold junctions are located in the pan below the lower air distribution plate (see paragraph (b)(4)). Thermopile hot junctions must be cleared of soot deposits as needed to maintain the calibrated sensitivity.

(3) Radiation Source. A radiant heat source for generating a flux up to 100 kW/m^2, using four silicon carbide elements, Type LL, 20 inches (50.8 cm) long by 5/8-inch (1.54 cm) O.D., nominal resistance 1.4 ohms, is shown in Figures 2A and 2B. The silicon carbide elements are mounted in the stainless steel panel box by inserting them through 15.9 mm holes in 0.8 mm thick ceramic fiber board. Location of the holes in the pads and stainless steel cover plates are shown in Figure 2B. The diamond shaped mask of 24-gauge stainless steel is added to provide uniform heat flux over the area occupied by the I50- by 150-mm vertical sample.

(6) Specimen Holders. The 150-mm x 150mm specimen is tested in a vertical orientation. The holder (Figure 3) is provided with a specimen holder frame, which touches the specimen (which is wrapped with aluminum foil as required by paragraph (d)(3) of this Part) along only the 6-mm perimeter and a "V" shaped spring to hold the assembly together. A detachable 12-mm x 12-mm x l50-mm drip pan and two .020-inch stainless steel wires (as shown in Figure 3) should be used for testing of materials prone to melting and dripping. The positioning of the spring and frame may be changed to accommodate different specimen thicknesses by inserting the retaining rod in different holes on the specimen holder.

Since the radiation shield described in ASTM E-906 is not used, a guide pin is added to the injection mechanism. This fits into a slotted metal plate on the injection mechanism outside of the holding chamber and can be used to provide accurate positioning of the specimen face after injection. The front surface of the specimen shall be 100 mm from the closed radiation doors after injection.

The specimen holder clips onto the mounted bracket (Figure 3). The mounting bracket is attached to the injection rod by three screws which pass through a wide area washer welded onto a 1/2-inch nut. The end of the injection rod is threaded

to screw into the nut and a .020-inch thick wide area washer is held between two 1/2-inch nuts which are adjusted to tightly cover the hole in the radiation doors through which the injection rod or calibration calorimeter pass.

(7) Calorimeter. A total-flux type calorimeter must be mounted in the center of a 1/2-inch Kaowool "M" board inserted in the sample holder to measure the total heat flux. The calorimeter must have a view angle of 180 degrees and be calibrated for incident flux. The calorimeter calibration must be acceptable to the Administrator.

(8) Pilot-Flame Positions. Pilot ignition of the specimen must be accomplished by simultaneously exposing the specimen to a lower pilot burner and an upper pilot burner, as described in paragraph (b)(8)(i) and (b)(8)(ii), respectively. The pilot burners must remain lighted for the entire 5-minute duration of the test.

(i) Lower Pilot Burner. The pilot-flame tubing must be 6.3 mm O.D., 0.8 mm wall, stainless steel tubing. A mixture of 120 cm^3/min. of methane and 850 cm^3/min. of air must be fed to the lower pilot flame burner. The normal position of the end of the pilot burner tubing is 10 mm from, and perpendicular to, the exposed vertical surface of the specimen. The centerline at the outlet of the burner tubing must intersect the vertical centerline of the sample at a point 5 mm above the lower exposed edge of the specimen.

(c)(1) Heat Release Rate. A burner as shown in Figure 4 must be placed over the end of the lower pilot flame tubing using a gas tight connection. The flow of gas to the pilot flame must be at least 99 percent methane and must be accurately metered. Prior to usage, the wet test motor is properly leveled and filled with distilled water to the tip of the internal pointer while no gas is flowing. Ambient temperature and pressure of the water are based on the internal wet test meter temperature. A baseline flow rate of approximately 1 liter/min is set and increased to higher preset flows of 4, 6, 8, 6, and 4 liters/min. The rate is determined by using a stopwatch to time a complete revolution of the wet test meter for both the baseline and higher flow, with the flow returned to baseline before changing to the next higher flow. The thermopile baseline voltage is measured. The gas flow to the burner must be increased to the higher preset flow and allowed to burn for 2.0 minutes, and the thermopile voltage must be measured.

The sequence is repeated until all five values have been determined. The average of the five values must be used as the calibration factor. The procedure must be repeated if the percent relative standard deviation is greater than 5 percent. Calculations are shown in paragraph (f).

(d)(1) The standard size for vertically mounted specimens is 150 x 150 mm with thicknesses up to 45 mm.

(e)(6) [Reserved]

(7) Injection of the specimen and closure of the inner door marks time zero. A record of the thermopile output with at least one data point per second must be made during the time the specimen is in the environmental chamber.

(f)(2) Heat release rates may be calculated from the reading of the thermopile output voltage at any instant of time as

$$HRR = \frac{V_m \times K_h}{.02323 m^2}$$

HRR = Heat release Rate kw/m^2
V_m = measured thermopile voltage (mv)
K_h = Calibration Factor (Kw/mv)

[INSERT FIGURES]

PART V - TEST METHOD TO DETERMINE THE SMOKE EMISSION CHARACTERISTICS OF CABIN MATERIALS

(a) Summary of Method. The specimens must be constructed, conditioned, and tested in the flaming mode in accordance with American Society of Testing and Materials (ASTM) Standard Test Method ASTM F81483.

(b) Acceptance Criteria. The specific optical smoke density (D_S), which is obtained by averaging the reading obtained after 4 minutes with each of the three specimens, shall not exceed 200

1159 - 1200. [RESERVED]

APPENDIX 1
CROSS REFERENCE FOR PART 25 and CAM 4b

DISTRIBUTION TABLE

Former Section	Revised Section	Former Section	Revised Section
4b.260----------	25.561	4b.361 (intro-	
4b.261----------	25.563	ductory	
4b.350----------	25.771	paragraph)	
4b.350-1----------	Not a rule	(last	
4b.351----------	25.773	sentence)----------	25.1585
4b.351-1----------	Not a rule	4b.361 (less intro-	
4b.351-2----------	Not a rule	ductory paragraph	
4b.351-3----------	Not a rule	(last sentence)-------	25.801
4b.352----------	25.775	4b.362 (intro-	
4b.353----------	25.777	ductory paragraph)-	25.803
4b.353-1----------	Not a rule	4b.362(a)----------	25.805
4b.356----------	25.783	4b.362(b)----------	25.807
4b.356-1 (less		4b.362(c)----------	25.807
last sentence)--------	Not a rule	4b.362(d)----------	25.807
4b.356-1 (last		4b.362(e)----------	25.809
sentence)----------	25.783	4b.362(f)----------	25.811
4b.356-2 (less (a)		4b.362(g) (last	
(1st sentence))------	Not a rule	sentence)----------	25.1557
4b.356-2(a) (1st		4b.362(g) (less	
sentence)----------	25.783	last sentence)--------	25.813
4b.356-3----------	Not a rule	4b.362 (less intro-	
4b.356-4----------	Not a rule	ductory para. and	
4b.356-5----------	Not a rule	(a)-(g))----------	25.815
4b.356-6----------	Not a rule	4b.362-1 (less (a))--	25.809 and
4b.358----------	25.785		25.811
4b.358-1 (less 2nd		4b.362-1(a)---------	25.805
and 3rd sentences)--	Not a rule	4b.362-2----------	25.807
4b.359----------	25.787	4b.362-3 (less (a))--	25.807
4b.360----------	Surplusage	4b.362-3(a)----------	Surplusage

Former Section	Revised Section	Former Section	Revised Section
4b.362-4----------	25.809	4b.738(c)----------	25.1556
4b.362-5 (less (c))--	25.811	4b.738(d)----------	25.1561
4b.362-5(c)----------	Not a rule		
4b.362-6----------	Not a rule		
4b.362-7----------	Not a rule		
4b.370----------	Surplusage		
4b.371----------	25.831		
4b.371-1----------	25.831		
4b.381----------	25.853		
4b.381-1----------	Not a rule		
4b.382----------	25.855		
4b.383 (less 2nd sentence of (a) and (b)(3))----------	25.857		
4b.383 (2nd sentence of (a) and (b)(3))-------	25.851		
4b.384----------	25.855		
4b.384-1----------	Not a rule.		
4b.605----------	25.1307		
4b.626----------	25.1359		
4b.626-1----------	Not a rule.		
4b.643----------	25.1413		
4b.644----------	25.1413		
4b.645 (less (e) and applicability to marking)----------	25.1415		
4b.645 (less (e) as applicable to marking)----------	25.1561		
4b.645(e)----------	25.1411		
4b.658----------	25.1433		
4b.730----------	25.1541		
4b.730-1----------	Not a rule		
4b.738(a)----------	25.1557		
4b.738(b)----------	25.1557		

APPENDIX 2
SYMBOLIC REGULATORY MESSAGES

*1. Figure 1. No Smoking (DOT)

*2. Figure 2. No Smoking (vertically challenged)

3. Figure 3. Fire Extinguisher

4. Figure 4. Fasten Seat Belt

*5. Figure 5. No Cigarette Disposal

6. Figure 6. Return to Seat

7. Figure 7. No Stowage

8. Figure 8. Life Raft

9. Figure 9. Oxygen

10. Figure 10. Megaphone

*Amendment 25-51, effective March 6, 1980, and AD 74-08-09, effective April 8, 1974, requires words for Lavatories.

Note: The FAA historically accepted the use of a red cross on a white background as being satisfactory for indicating first aid kits. The agency has been advised by the American Red Cross that the use of this symbol is limited by international and federal law, with the exception of certain pre-1905 users, military establishments and the American Red Cross. At this time the FAA does not have a recommended symbol for first aid kits.

Figure 1. **NO SMOKING (DOT)**

Preferred version. Use wherever dimensional constraints permit. The circle-slash should be red, the cigarette and smoke black and the background white. The circle-slash should override the cigarette.

Figure 2. **NO SMOKING**

Vertically challenged version -- square "field" not applicable. If the sign is unlit, the cigarette may appear in positive form (dark gray) or negative (white). In the negative unlit version, provide sufficient background contrast for the red circle-slash. The negative form shown is recommended for a lighted sign. The circle-slash should be red and override the background or cigarette.

Figure 3. **FIRE EXTINGUISHER (DOT)**

The fire extinguisher should be red and the background white.

Figure 4. **FASTEN SEAT BELT**

For lighted sign use. Square "field" not applicable and may be cropped to fit a small vertical dimension. The arrow should be red, the seat belt white, and the background black or sufficiently contrasting to the red arrow.

Figure 5. **NO CIGARETTE DISPOSAL**

This symbol is intended for application to waste disposal openings. The circle-slash should be red and override the cigarette and receptacle. The cigarette smoke and receptacle should be black and the background white. Caution: Use of etch and fill media for reduced symbols should be avoided as metal necessarily exposed between colors diminishes symbol's understanding.

Figure 6. **RETURN TO SEAT**

To be used in lighted signage exclusively. The figure and seat may appear in either the positive form (dark gray) or negative form (lighted-white). The arrow should be red.

Figure 7. **NO STOWAGE**

The circle-slash should be red and override the suitcase. The suitcase should be black and the background white.

Figure 8. **LIFE RAFT**

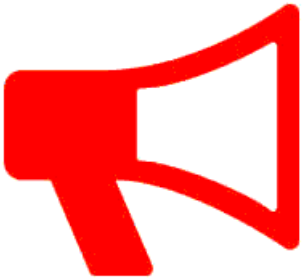
The life raft should be red, the person and wave black.

Figure 9. **OXYGEN**

The bottle and printing should be green and the background white.

Figure 10. **MEGAPHONE**

The megaphone should be red and the background white.



APPENDIX 3
CRASHWORTHINESS ADVISORY CIRCULARS

1. 20-33B Technical Information Regarding Civil Aeronautics Manuals 1, 3, 4a, 4b, 5, 6, 7, 8, 9, 13, and 14 (5/1/75).

2. 20-36Q Index of Articles (Materials, Parts, Processes and Appliances) Certified Under the Technical Standard Order System (7/16/85).

3. 20-38A Measurement of Cabin Interior Emergency Illumination in Transport Airplanes (2/8/66).

4. 20-41A Substitute Technical Standard Order (TSO) Aircraft Equipment (4/5/77).

5. 20-42C Hand Fire Extinguishers for use in Aircraft (8/25/82).

6. 20-47 Exterior Colored Band Around Exits on Transport Airplanes (2/8/66).

7. 20-56A Marking of TSO-C72b Individual Flotation Devices (4/1/75).

8. 20-60 Accessibility to Excess Emergency Exits (7/18/68).

9. 20-90C Directory of Engineering and Manufacturing District Offices (4/30/81).

10. 20-110A Index of Aviation Technical Standard Orders (1/2/83).

11. 20-118 Emergency Evacuation Demonstration From Small Airplanes (7/12/83).

12. 21-22 Injury Criteria for Human Exposure to Impact (6/20/85).

13. 21-34 Shoulder Harness-Safety Belt Installations (6/4/93)

14. 23-2 Flammability Tests (8/20/84). *

15. 23.807-1 Emergency Exits in Small Airplanes (9/7/83). *

16. 23.807-2 Doors Between Pilot's Compartment and Passenger Cabin in Small Airplanes (9/22/83). *

17. 23.807-3 Emergency Exits Openable From Outside for Small Airplanes (1/20/84). *

18. 25-9 Smoke Detection, Penetration, and Evacuation Tests, and Related Flight Manual Emergency Procedures (7/29/86).

19. 25-10 Guidance for Installation of Miscellaneous, Nonrequired Electrical Equipment (3/6/87).

20. 25.562-1A Dynamic Evaluation of Seat Restraint Systems & Occupant Protection on Transport Airplanes (1/19/96).

21. 25.783-1 Fuselage Doors, Hatches and Exits (12/10/86).

22. 25.785-1A Flight Attendant Seat and Torso Restraint System Installations (1/6/96) .

23. 25.803-1 Emergency Evacuation Demonstrations (11/13/89).

24. 25.807-1 Uniform Distribution of Exits (8/13/90).

25. 25.812-1A Floor Proximity Emergency Escape Path Marking (5/22/89) .

26. 25.853-1 A Flammability Requirements for Aircraft Seat Cushions (9/17/86).

27. 27-1 Certification of Normal Category Rotorcraft (8/29/85).

28. 29-2 Certification of Transport Category Rotorcraft (5/20/83).

29. 43.13-1A Acceptable Methods, Techniques and Practices-Aircraft Inspection and Repair (4/17/72).

30. 43.13-2A Acceptable Methods, Techniques and Practices-Aircraft Alterations (6/9/77).

31. 91-8B Use of Oxygen by Aviation Pilots/Passengers (4/7/82).

32. 103-4 Hazard Associated with Sublimation of Solid Carbon Dioxide (Dry Ice) Aboard Aircraft (5/1/74).

33. 120-38 Transport Category Airplanes Cabin Ozone Concentrations (10/10/80).

34. 120-47 Survival Equipment for use in Overwater Operations ((6/12/87)

35. 121-24A Passenger Safety Information Briefing and Briefing Cards (5/9/89) .

* Not directly applicable to Part 25 airplanes.

APPENDIX 4
TEST PROCEDURE FOR EVALUATING NON-STANDARD EXITS
FOR TRANSPORT CATEGORY AIRPLANES

1. Where it is necessary to determine the acceptability of a non-standard exit arrangement for which an applicant has requested an exemption from applicable FAR's, full scale testing should be employed using representative subjects under conditions such that accurate comparisons may be made.

2. Purpose of the Test. The purpose of the test is to determine that the mean escape time using the proposed exit configuration is equal to or better than the time required to use an exit configuration defined by pertinent Federal Aviation Regulations applying to Transport Category Airplanes. The results can be used to substantiate equivalency for an exemption or an equivalent level of safety determination. This test procedure should not be used for determining the rating of an exit or exit configuration, since it is not extensive enough for such a determination.

3. Experimental Conditions.

a. Direct comparisons are to be made between escape time using the proposed exit or exits and corresponding acceptable arrangements. A proposed exit arrangement may be one or more openings not conforming in all respects to applicable FAR's which would, if approved, replace such opening or openings specified in the regulations.

b. A mockup of a section of the fuselage may be used such that arrangement of exit, passenger seats, step-up distance from cabin floor to exit sill and step-down distance from sill to wing or step simulate those proposed for the airplane. If high-density seating is to be used, the minimum distance between the seats should be simulated. Where over-the-wing exits are being tested and the step-down distances of two or more proposed exits differ, either the greater step-down distance should be used, or the several proposed exits should be simultaneously compared with the conventional arrangement they are designed to replace. In the case of floor level exits which are not located over the wing, or overwing exits which are not located over the wing, or overwing exits which are at a greater distance than is specified in FAR, the step, or descent device, shall simulate those designed for operational use and the device or conditions of us shall be fully described, including details of the dimensions. If production devices are available, they should be used.

c. At the start of each trial, subjects may either be seated with belts fastened or may be standing in line, whichever is more convenient, provided that the procedure is maintained consistently for each trial included in the test.

d. Subjects should not be permitted any trials prior to the test, but may be briefed as to the method of escape. The context of the briefing should be reported. Examples of briefing to ensure rapid egress in escaping through window exits would be the instruction to pass through one foot first, then head and body, then the other foot, i.e., "foot first, then head." Examples of

instructions for escaping through a door via an escape slide are: "Jump into slide," "Do not hold on," "Keep sitting position."

4. Statistical Design.

a. As many subjects should be used as time, funds, and facilities permit. As a minimum, the number of persons in each group should be approximately 1/2 the exit rating specified for the standard exit in § 25.807(c)(4), but no less than 25.

b. The subjects should be assigned to a number of subgroups equal to or a multiple of, the number of configurations to be tested, including the standard. As noted above, the number of subjects in each subgroup should be at least 25.

c. The subgroups should be as nearly alike as possible with respect to physical agility, age, sex, weight, and the like. This can be achieved by first stratifying the total set of subjects by age and sex and then subdividing each age-sex group at random into the required number of subgroups. The age-sex distribution in each subgroup need not be that stated in § 25.803(c)(8)(i), (ii), and (iii). The subjects should range in age from approximately 20 to 60 years of age with approximately 30% of the subjects being female. The dolls of § 25.803(c)(8)(iv) need not be included.

d. Each subgroup should test each configuration, but the order of trials should be different for each subgroup and should be chosen in accordance with the principle of the Latin Square. The principle of the Latin Square is that each configuration be tried once by each group and appear once in each possible order. Thus if there are two arrangements to be tested, and therefore, two subgroups labeled A and B, say, then group A should try first the standard then alternative arrangement, Group B should make trials in the reverse order. For the case of three configurations, group A might try first the standard, then the first alternative and last the second alternative; group B would try the first alternative, second alternative and standard, in that order; and group C would first try the second alternative, then the standard and lastly, the first alternative. The arrangement eliminates the effects of individual participants learning, fatigue and agility.

5. Record of Results.

a. Motion picture records of the trials should be made.

b. Elapsed time for the demonstration should be recorded on each motion picture record. Synchronized electronic cameras may be used with the time superimposed in the film processing. A signal light to indicate on the film the beginning, end and duration of each trial should be arranged in the camera field. Test board should be photographed to show the essential details illustrated by each motion picture sequence.

c. The time in tenths of a second from the start of the trial to the instant at which each individual first has both feet on the wing (or if a step is required between the exit and the wing, the time for both feet on the wing, not the step), or the ground at the foot of the slide, according to the conditions of the test, will be determined from the film. This series of times will comprise

the cumulated individual escape times for each trial. The individual escape time required for analysis can be obtained by successive subtraction in reverse order.

6. Determination of Results.

a. The effectiveness of the non-standard exit, or exits being tested, are compared with the standard exit by comparing the average time of the subgroups to pass through each exit tested. The effects of learning in the subgroups are canceled by use of the Latin Square principle.

b. It is possible that, in spite of efforts to keep the composition of the subgroups equal, that one group may contain one or two persons who find it particularly difficult to go through exits. The Latin Square principle will also cancel such unbalance between subgroups.

c. It may happen that an individual may, through chance, have considerable difficulty with an exit, but his other performance may compare with the average performance of other individuals. A study of the individual escape times will enable such occurrences to be evaluated and assist in the final determination of the acceptability of the proposed exit, or exits.

NOTE: Exemptions must be processed in accordance with FAR part 11. In the evaluation of a request for exemption the recommendations of the controlling Directorate are requested. The foregoing procedure will assist the Directorate in determining what their recommendation should be when the exemption request involves emergency exits.

This appendix was derived from Order 8110.12, 5-21-64.

APPENDIX 5
CRASHWORTHINESS TECHNICAL STANDARD ORDERS (TSO)

1. TSO-C13f, Life Preservers

2. TSO-C22g, Safety Belts

3. TSO-C39b, Aircraft Seats and Berths

4. TSO-64a, Oxygen Mask Assembly, Continuous Flow, Passenger

5. TSO-C69b, Emergency Evacuation Slides, Ramps, and Slide/Raft Combinations

6. TSO-70a, Liferafts (Reversible and Non-Reversible)

7. TSO-C72c, Individual Flotation Devices

8. TSO-C91a, Emergency Locator Transmitters (ELT) Equipment

9. TSO-C114, Torso Restraint Systems

10. TSO-C116, Crewmember Protective Breathing Equipment (PBE)

11. TSO-C126, 406 MHz Emergency Locator Transmitter (ELT)

12. TSO-C127, Rotorcraft and Transport Airplane Seating Systems

APPENDIX 6
INTERIOR COMPLIANCE CHECKLIST- EXAMPLE

This checklist is only a guide to performing an interior compliance inspection. The checklist is as inclusive as practical, but no checklist can identify all items that might be encountered on any given inspection. In addition, the difference between a "first of a model" and a follow-on interior change can result in quite different inspection requirements, so frequent updating of this checklist is recommended. Make sure you verify the type certification basis of the airplane that you are evaluating. No two airplane models have exactly the same certification basis.

Use the checklist to remind yourself of the sorts of items that you should be looking at, rather than as a list of everything that you need to look at.

Section 25.785 Seats, berths etc.

* Do all seats have a TSO?
* Are there any potentially lethal objects within striking radius of the head? Bulkheads, slide containers, seat armrests etc.
* Do armrests fold up beyond the seat back?
* Do footrests incorporate any potentially injurious features (to persons attempting to deploy or stow them)? If they deploy into required crossaisles or passageways, is there a mechanical lock-out in the stowed position?
* Do all seats have approved seatbelts? Is there a tendency for the seat belt shackle to become tangled or hung up on seat structure?
* Do all F/A seats have shoulder harnesses as well as lap belts?
* Is flight attendant direct view no worse than on previous arrangements? For those airplanes with this requirement as part of the certification basis, do they meet the current criteria?
* Is there a handhold for passengers to steady themselves?
* Are all projecting objects, that could be contacted in flight, padded?
* Are all flight attendant seats located near a required floor level exit?

Section 25.787 Stowage compartments

* Does each compartment have a weight limit placard?
* Are all compartments completely enclosed?
* Are double latches present where necessary?
* Are there provisions to account for wear and tear in service?
* Are means of latching positive with a positive indication when latched or unlatched?

Section 25.789 Retention of items of mass

* Is compartment sub-division (critical load distribution) accounted for in weight limits i.e., single carts in a two cart stall?

* Are meal containers stowed in pairs, and is this accounted for with latches or placarding?
* Are there restraints in each direction (including aft and up)?

Section 25.791 Passenger information signs

* Is a passenger information sign visible from each flight attendant and passenger seat?
* If there are seats that translate or swivel, is a sign visible from each seat position?

Section 25.803 Emergency evacuation

* Are there any tripping hazards present in the aisle, crossaisles or passageways?
* Are there any other impediments (projecting objects) to rapid evacuation (head, arms legs)?
* Are there any data sheet limitations regarding passenger capacity that are relevant to the interior arrangement?
* {See also video monitors}

Section 25.807 Passenger emergency exits

* Do all clear exit openings equal or exceed the minimum required dimensions, including any protrusions from linings, hinges etc.?
* Are step-ups to and step-downs from exits within the requirements?
* Is there a flt. att. seat positioned adjacent to each Type A exit?

Section 25.809 Emergency exit arrangement

* Are exits openable from inside and outside?
* Are all exits openable within 10 seconds?
* Is the means of opening simple and obvious, i.e. could an untrained passenger do it?
* Is the means of opening protected from inadvertent operation?

Section 25.811 Emergency exit marking

* Are all of the required signs (locator, bulkhead, marking) present and visible to persons in the main aisle?
* Is the next exit sign visible from each point in the aisle?
* Are all exit signs positioned such that they lead persons to exits and not into galleys or other "dead ends"?
* Do curtains or other features, e.g. video monitors, interfere with exit sign visibility?
* Are exit operating instructions clear?
* Are exits identifiable from a distance equal to the airplane width?

Section 25.812 Emergency lighting

* Are floor proximity escape path markings continuous to exits and to the ends of aisles?
* Do baggage bars or carry-on baggage block floor prox. lights?

* Are overwing exits given additional aisle cues to draw attention to their location?
* Has the interior arrangement affected the original basis of the emergency lighting approval i.e. location of interior features, ceiling changes that might create new shaded areas?

Section 25.813 Emergency exit access

* Are all passageways unobstructed from the aisle to the exit opening, including galley features, retracted flight attendant seats and consideration of assist space?
* Are assist spaces that are 12"x20" on the floor and usable provided at all floor level exits that have slides?
* Is an assist handle provided at the assist space? (Is an assist handle required?)
* Is there an unobstructed projected opening of overwing exits for the width of a seat, including the seatback in any position? (tools are required to defeat lockouts)
* Are overwing hatches openable without interference, from the inside and outside?

Section 25.815 Width of aisle

* Are any aisle widths compromised by recline or breakover of seatbacks? At divided zones?
* Do rubstrips reduce the required aisle?
* Are curtain tiebacks readily movable, where they project into the required aisle?
* Do movable armrests that protrude into the required aisle return to the normal position when released? Are there appropriate placards for the armrests (where there are only one or two?)

Section 25.853 Compartment interiors

* Are waste compartments completely enclosed?
* Are there any areas where waste material could accumulate? Behind stowage units, sidewalls, seat armrest cavities?
* Are ashtrays installed outside all lavatories?
* Are all electrical wires protected from abrasion or crushing?
* Are all seats fireblocked?
* Has the applicant provided documentation that all materials in the cabin have been suitably tested to the applicable flammability test?

Section 25.1411 General (Safety Equipment)

* Is emergency equipment readily accessible (not requiring special skills to remove)? Consider reclined seats, stowage of other equipment, stowage of carry on baggage.
* Are emergency equipment stowage locations conspicuously and conveniently marked? Are placards as close to eye height as practicable? Are additional arrows needed to locate the specific stowage location?
* Do curtains block access to, or markings of, emergency equipment?
* Is emergency equipment protected from damage in its stowage location?

* Are there sufficient type and quantity of required items, i.e., fire extinguishers, oxygen bottles etc.?
* Are life vests easily removable by a seated, untrained person, at all locations? Is there a placard for all seats, including the forward rows, indicating the location of the vests?
* Are there lifeline stowage provisions for all models required to have a lifeline?

Section 25.1447 Equipment Standards for oxygen dispensing units

* Are all oxygen masks reachable by 5th percentile female to 95th percentile male?
* If the activation of oxygen flow is initiated by pulling on a lanyard, does mask drop height allow donning without activation of oxygen flow? Check in lavatories.
* Are there 10% excess mask drops distributed throughout the airplane?
* Is mask presentation obvious to all occupants?
* Will mask presentation be confused by occupants of the seat row behind?
* Are all positions of translating/swiveling seats accounted for?
* Do open stowage compartment doors interfere with mask drops?
* Are masks reachable by reclined passengers in sleeper seats? Streamers may be necessary to improve reachability of the masks from that position.

SPECIAL AREAS OF ATTENTION

Galleys:

* Are there any compartment doors that could interfere with exit opening? Are they spring loaded closed?
* Are there any folding cart ramps that could be left down for takeoff and landing? Do they pose a tripping hazard?
* Are all waste compartment doors self closing or marked to be closed when not in use?
* Are fixed items (ovens, coffee makers) installed for inspection?
* Is all wiring protected from abrasion, especially from rotable items?
* Are the load limit and "close for taxi, takeoff, and landing" placards conspicuous, even when compartment doors are open?

Lavatories:

* Does the lav door open into the aisle? Is it spring loaded closed if evacuation flow tends to force it or keep it open?
* Are oxygen drops compatible with both standing and seated occupants?
* Are there any potential stowage areas that could lead to a fire hazard? Do these have "NO STOWAGE" placards?
* Is there an ordinance sign?
* Is there a means to unlock the lav door from the outside, without the use of tools?
* Are waste compartments designed with wear and tear in mind? (latch engagement, degree of compartment sealing)?

Video Monitors:

* Are aisle mounted monitors at least 73" off the floor, or retractable and so placarded?
* Have all sharp corners been eliminated from the monitor shroud?
* Do the monitors obscure any required exit sign?
* Is there a manual means to retract monitors that are normally powered?
* Do in-arm monitors easily break away if contacted by a passenger during turbulence? Are possible head contact surfaces padded?
* Are monitors located under sidewall stowage bins retractable?
* Can front row monitors be stowed, or become unstowed, such that they interfere with exit passageways, or other egress routes?
* Do in-arm video monitors break away easily without breaking off or, if they do break, are there any sharp or hazardous protrusions? Is the monitor capable of being re-stowed for TTL?
* Is required placarding for stowage visible to the seated occupant?
* Is the in-arm IVS cavity "completely open or completely closed" to address the collection of flammable materials?

APPENDIX 7
AMENDMENT BY AMENDMENT HISTORY OF MAJOR CRASHWORTHINESS REQUIREMENTS

1. Amendment 25-15 (eff. 10/24/67)
   a. Introduced §§ 25.2 (special retroactive requirements), 25.803 (emergency evacuation), 25.812 (emergency lighting), and Appendix F (flammability test methods).
   b. Added type A exits (with a 100 passenger rating) to §25.807.
   c. Revised § 25.809 to require slides or equivalent.
   d. Revised § 25.853 to upgrade flammability standards.

2. Amendment 25-32 (eff. 5/1/71)
   a. Introduced §§ 25.789 (retention of items of mass) and 25.791 (passenger information signs).
   b. Revised § 25.787 to require carry-on baggage and equipment stowage units to be placarded for their maximum stowage weight, rather than just cargo and baggage compartments, and to require that they be completely enclosed.
   c. Revised § 25.853 and Appendix F to make a major improvement in the flammability characteristics of interior materials.

3. Amendment 25-46 (eff. 12/1/78)
   a. Revised § 25.803 to allow the use of analysis in lieu of demonstration.
   b. Revised § 25.809 to add the 25-knot wind capability requirement for slides.
   c. Revised § 25.811 to require the illumination of operating handles for Type I and Type A exits.
   d. Revised § 25.813 to improve the access to Type III exits on airplanes with 20 or more seats.

4. Amendment 25-51 (eff. 11/26/84)

   a. Revised § 25.785(h) to greatly expand flight attendant seat requirements, including addition of flight attendant direct view.
   b. Revised § 25.787 to require latch designs on stowage compartments to consider wear and tear.
   c. Added § 25.793 to require slip resistant surfaces in areas likely to become wet in service.
   d. Revised § 25.853 to strengthen requirements on lavatory waste receptacles.

5. Amendment 25-58 (eff. 11/26/84), Floor Proximity Emergency Escape Path Marking

   a. Revised § 25.812 by adding a new paragraph (e) to require a means to locate exits in conditions when lighting above 4 feet is totally obscured.

b. AC 25.812-1 was issued on 9/30/85 to aid in finding compliance with the regulation, including how to conduct an evaluation using naive participants.

6. Amendment 25-59 (eff. 11/26/84), Flammability Requirements for Aircraft Seat Cushions

a. Revised § 25.853 by adding a requirement for seat cushions, back and bottom, except on flight crewmember seats, to meet a new stringent flammability test using a 2 gallon/hour kerosene burner. The test was placed in a new Part II to Appendix F.
b. AC 25.853-1 was issued on 9/17/86 to provide guiding in how to prepare samples for the test and the conduct of the test.

7. Amendment 25-60 (eff. 6/16/86), Fire Protection Requirements for Cargo or Baggage Compartments

a. Introduced a new flammability test, Part III, to Appendix F which uses the 2 gallon/hour kerosene burner.
b. The sidewall and ceiling panels of Class C and Class D cargo compartments must meet the new flammability requirements.

8. Amendment 25-61 (eff. 8/20/86), Improved Flammability Standards for Materials Used in the Interiors of Transport Category Airplane Cabins

a. Introduced a new flammability test, Part IV, to Appendix F which uses a new test apparatus commonly referred to as a rate-of-heat-release chamber or an OSU chamber. The latter designation is for the institution at which the test method was developed; Ohio State University.
b. Amended § 25.853 by adding a new paragraph, (a-1), which requires that the large surface panels in the interior of airplanes with passenger capacities of 20 or more to meet the new Part IV test.

9. Amendment 25-64 (eff. 6/16/88), Improved Seat Safety Standards

a. Introduced new dynamic test requirements for seats in transport category airplanes of all sizes in a new § 25.562.
b. Introduced new occupant protection performance measures to be met under the dynamic conditions.
    1. A head injury criterion (HIC) of less than 1,000 units.
    2. A spinal compression load not to exceed 1,500 pounds.
    3. Axially compressive loads on the femur not to exceed 2,250 pounds.
c. Increased the static load requirements of § 25.561 in the upward, sideward and downward directions and introduced a rearward static load.
d. AC 25.562-1 was issued on 3/6/90 to provide guidance toward showing compliance with the new dynamic requirements.

e. An FAA team which typically includes the Crash Dynamic National Resource Specialist, a representative from the CAMI dynamic test labs, and a representative from the Aircraft Certification Service, usually visits test facilities seeking to provide certification data for dynamic tests.

10. Amendment 25-66 (eff. 9/26/88), Improved Flammability Standards for Materials Used in the Interiors of Transport Category Airplane Cabins

a. Made refinements in the Part IV test of Appendix F.
b. Added a smoke emissions test, Part V, to Appendix F which utilizes a test specified by Test Method F814-83 of the American Society of Testing and Materials (ASTM).
c. Revised § 25.853(a-1) to require materials which had to comply with Part IV of Appendix F to also comply with Part V of Appendix F.

11. Amendment 25-67 (eff. 9/26/88), Location of Passenger Emergency Exits in Transport Category Airplanes

a. Revised § 21.183 by adding a new paragraph (f) which prevents the issuance of a standard airworthiness certificate to a transport category airplane manufactured after October 16, 1987, which does not meet the new requirements of § 25.807(c)(7).
b. Revised § 25.2 to require that each applicant for a supplemental type certificate meet the new requirements of § 25.807(c)(7).
c. Added a new § 25.807(c)(7) which requires that airplanes with more than one pair of exit on each side of the fuselage may not have adjacent passenger emergency exits more than 60 feet apart.

APPENDIX 8
TEST METHODS FOR FIRE CONTAINMENT OF CONTAINERS, CARTS, AND COMPARTMENTS

l. To demonstrate fire-containment capabilities by test of or similarity to approved containers, carts, or compartments used to store combustible material for showing compliance to § 25.853(d).

2. PURPOSE.

To demonstrate that food service carts, waste material or refuse carts and compartments with waste containers used to receive combustible materials such as food service refuse, paper towels, napkins, paper cups, etc., and subject to accidental ignition, will contain a fire. Carts not usable as waste containers need not be tested.

3. TEST REQUIREMENTS.

a. The waste compartment, cart, or waste container used for test should be equivalent to a production unit with regard to material and design, as shown by the test and production drawings provided.

b. The waste compartment, cart, or waste container should be tested in the same environment as would occur on the airplane. This includes a complete production enclosure or a simulated configuration that totally duplicates the in-service application, including as a minimum, seals, chutes, ducts, sealant, doors, lids, drain lines, vent lines, compartments with or without containers, and environmental conditions. Tests for waste compartments which contain overboard drains that are vented by differential pressure should be tested with the maximum possible airflow simulated. Tests for chilled carts that receive conditioned air from a chiller unit should also be connected to simulated ducts and have the same air flow through the cart that would occur when in use on the airplane.

c. Chilled carts should be tested to demonstrate containment representative of two use conditions:

(l) Stowed in the galley unit and connected to the ducts that distribute the conditioned air and with the design air flow rates being used, and (see paragraph 3.b.).

(2) Removed from the galley, which would represent the unstowed (disconnected) use condition.

d. The following information is requested for tests to be witnessed by FAA personnel or their representatives:

(l) Identification and location(s) of unit(s) where conformity inspection(s) and test(s) are to be conducted.

(2) Name and telephone number of Project engineer at the above location(s).

(3) Approximate date(s) that the unit(s) will be available for inspection.

e. FAA or appointed designee should inspect the cart, waste container, or waste compartment for conformity prior to the test.

f. The following suggested materials may be used for this test:

(1) Material to be ignited in the waste compartment, waste container, or waste cart should consist of the following typical mixture of crumpled combustibles:

(i) Eight paper hand towels--two ply, approximately l0 x 11 inches (40% by number)

(ii) Five paper napkins--two ply, approximately 16 x 16 inches (25% by number)

(iii) Four paper hot drink cups--8 oz. size (20% by number)

(iv) Two paper cold drink cups--3 oz. size (l0% by number)

(v) One empty cigarette package (5% by number)

The total amount of combustible material in the above proportions should be sufficient to fill the waste container, compartment, or cart to 3/4 full. Any changes to this mixture should be approved by the FAA.

(2) Combustible materials used for meal cart tests should be representative of those regularly used. If the airline for which the cart is intended uses noncombustible dishes, the test should be conducted with combustible dishes. The airline may change or the cart may be used by another airline which uses combustible dishes. Normally this will include:

(i) One cup

(ii) One salad dish

(iii) One salad dressing container

(iv) One entree dish

(v) One dessert dish

(vi) Three eating utensils (i.e., knife, fork, spoon)

(vii) One crumpled paper napkin--two ply, approximately l6 x l6 inches

The total amount of trays, each containing the materials in the above proportions, shall be sufficient to fill the cart. Remove the tray above the one to be ignited to give the fire some air. Ignite the materials on the second or third tray up from the bottom. Entree or heated carts, if they contained ignition sources, should be tested by igniting an entree dish (the second or third one up from the bottom) or equivalent filled l/2 full of alcohol to simulate a grease fire and remove the tray above the one that is to be ignited. If the entree cart is used as a serving cart or for storage of used materials, the procedures used for standard cart tests should also be followed.

(3) A thermocouple and readout system capable of continuously recording the temperature within the item being tested may be used.

4. TEST PROCEDURES.

4.l WASTE COMPARTMENT AND WASTE CONTAINER.

a. All waste compartments with nonmetallic waste containers should be tested with the containers installed (4.1c and 4.1e through 4.1h) and also with the container removed (4.1d through 4.1h). Alternatively, it may be analyzed which condition (with or without the container) is more critical and only that condition need be tested. Waste compartments with metal waste containers should be tested without the container (4.1d through 4.1h).

b. If the compartment is not tested with the container removed, the outside of the compartment must be conspicuously placarded to require the container be in place.

c. Install the waste container loosely filled with material per 3.f.(l) and close all doors. Proceed with 4.1e through 4.1h.

d. Loosely fill the waste compartment, without the waste container, with material per 3.f.(l) and close all compartment doors.

e. If a thermocouple is used, install it through the waste compartment lid or other suitable opening such that the thermocouple bead is located l.5 to 2.0 inches above the surface of the waste material.

f. Ignite the waste material in the container or compartment by inserting a crumpled lighted paper towel through the waste compartment lid or chute. Ensure development of an adequate fire by allowing approximately 50% of the waste material surface area to ignite prior to closing the lid. It is best to light the back surface first and work forward. The flame coverage is deceiving; be absolutely confident at least 50% of the surface is ignited.

g. The temperature indicated by the thermocouple will increase after ignition and then start to drop as the flame subsides. When the thermocouple indicates a temperature below l50°F., or does not reignite when the door is opened, the test is complete. Open the compartment door, remove the waste container if used, and inspect the container, cart, and/or compartment for damage.

h. It is recommended that the applicant take photographs prior to and after test, record thermocouple temperatures, if used, and record all observations during the test. The photographs, temperatures, and observations should be included in the test report.

4.2 CARTS.

a. All tests are to be conducted in an open area equivalent to an aircraft cabin environment or connected to the conditioned air ducts in the galley unit (see 4.2g).

b. Load carts with materials as listed in 3.f.(l) for waste carts and 3.f.(2) for meal, entree (heated) or air chilled carts.

c. If used, install the thermocouple through the waste access door or other suitable opening such that the thermocouple bead is located l.5 to 2.0 inches above the surface of the top tray.

d. Meal Carts. For meal cart tests, ignite two crumpled paper napkins and place adjacent to other combustible items on the lower tray. Remove the tray above for the test. Allow a good flame front to develop by allowing approximately 50% of the surface area of the napkin to ignite. Insert tray and close all cart doors.

e. Waste Carts. For waste carts, use the procedure called out in Section 4.l.

f. Entree (Heated) Carts. For entree or heated carts, ignite a pan of alcohol the size of an entree dish, and insert into the cart on the lower shelf (see 3.f.(2)). Remove the tray above for the test.

g. Air-Chilled Carts.

(l) The air chilled carts should have all openings, gaskets, seals, and connectors representative of the production carts installed or simulated.

(2) Air chilled carts should be loaded with the items as listed in 3.f.(2).

(3) Air chilled carts should be tested under two conditions as follows:

(i) Stowed within galley

(A) If used, install the thermocouple through the access door or other suitable opening such that the thermocouple lead is located l.5 to 2.0 inches above the surface of the top tray.

(B) Ignite two crumpled paper napkins and place adjacent to the other combustible items on the lower tray. Remove the tray above for the test. Allow a good flame front to develop by allowing approximately 50% of the surface area of the napkin to ignite. Insert the tray and close all cart doors.

(C) Place the cart into the galley structure so that it is connected or attached to the chilled air distribution ducts with the designed airflow volume. Circulate air through the cart at the designated airflow rate.

(ii) Unstowed Carts.

(A) Remove the cart from the chilled air distribution duct.

(B) Use the procedure listed in items 4.2g.(3)(i)(A) and 4.2g.(3)(i)(B).

h. The temperature indicated by the thermocouple will increase after ignition and then start to drop as the flame subsides. When the thermocouple indicates a temperature below 150° F., or does not reignite when the door is opened, the test is complete. Open the compartment door, remove the waste container if used, and inspect the container, cart, and/or compartment for damage.

i. Take photographs prior to and after test, record thermocouple temperatures, if used, and record all observations during the test. The photographs, temperatures, and observations should be included in the test report.

5. ACCEPTANCE CRITERIA.

a. Compliance to § 25.853(d) requires that the waste compartment/container or cart, as applicable, "must be at least fire resistant" (meet the 45 degree burn test contained in paragraph 621.b(2) of this AC or, alternatively as later promulgated by Amendment 25-32 in § 25.855(a-1)) and be able to contain the fires described in Section 4.

b. Damage to the waste compartment/container is acceptable provided the waste compartment does not burn through or ignite surrounding materials or no flame issues from waste compartment or cart.

c. Damage to carts and contents is acceptable provided the container portion of the cart does not burn through.

6. FIRE CONTAINMENT BY SIMILARITY REPORT. A unit that is similar in construction, materials, and volume to a unit previously approved by FAA may be approved without a fire containment test, with a similarity report that satisfactorily demonstrates the similarity.

6.1 PURPOSE. The similarity report should state the purpose, which is to show by similarity to previously approved units, that waste containers, waste compartments, and carts containing combustible materials contain a fire in compliance with this document and § 25.853(d). The report should also include:

a. Identification by part and drawing number of items to be approved by similarity to previously approved items.

b. Identification of airplane(s) in which the item will be installed as well as the airplane and airline customer for which the original test was conducted. A copy of the original test report should also be attached or referenced.

c. Identify § 25.853(d) for which compliance will be demonstrated by similarity.

6.2 DESCRIPTION OF SIMILARITY SPECIMEN. Drawing numbers, photographs, etc., for items to be approved by similarity, and previously approved unit to which they are being compared should be provided.

6.3 SIMILARITY REQUIREMENTS.

a. Configuration should be adequately defined by production drawings or equivalent sketches and layouts.

b. Construction or fabrication of the subject unit should be similar to previously approved unit as shown by drawing or sketches with part numbers.

c. Ventilation or air leakage paths (length or area) should be equal to or less than previously approved unit. Air gap dimensions between waste compartment access or chute doors and sill should be shown on sketches or drawings.

d. Compartment volume should be equal to or less than previously approved unit, and tabulated for both units. Include dimensions and volume comparisons of the unit tested and of the unit to be approved by similarity.

e. A statement should be made in the report verifying that the design permits no waste material to fall out of the stowage or waste compartments as installed in the airplane.

6.4 CONCLUSION.

a. A statement should be made in the report verifying that the design confines a fire within the waste compartment and does not present a hazard to personnel or other compartments.

b. A statement should be made in the report that the galley or lavatory waste container and compartments are qualified to § 25.853(d) based on the attached comparison analysis that shows these units to have equivalent fire containment capabilities of the previously approved test unit documented in the referenced report.

***